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DEPARTMENT OF AGRICULTURE.

VITICULTURAL STATION, RUTHERGLEN, VICTORIA.

NEW METHODS  
OF  
GRAFTING AND BUDDING,  
AS APPLIED TO  
RECONSTITUTION WITH AMERICAN VINES.

*Compiled and Translated from French Authorities*

BY

RAYMOND DUBOIS, B.Sc. (Paris),

*Diplômé E.A.M.; Director of the Viticultural Station; Chief Inspector of  
Vineyards for Victoria;*

AND

W. PERCY WILKINSON,

*Consulting Analyst to the Board of Public Health and the M. and M. Board of  
Works; Private Assistant to the Government Analyst.*

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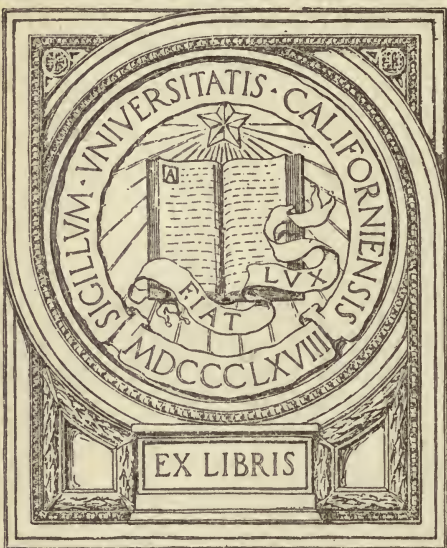
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## INTRODUCTION.

When two branches or stems of closely related plants, growing side by side in a forest, overlap and touch each other, the bark becomes bruised and abraded. In such cases it has been frequently observed that the sap exuding from the alburnum produces pads (callus) by which incorporation or knitting of the tissues takes place and the parts become one. Thus the usual method of grafting may have originated.

Grafting above ground and budding as applied to vines is not a new invention; it was a common practice with the Romans, while grafting underground was the exception.

This method is considered by many to be a discovery of the end of the nineteenth century, yet it was described by Palladius,\* Columella,† Varro,‡ and Cato,§ the only Latin

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\* *Rutilius Taurus Emilianus* Palladius, who lived sometime between 140 and 380 A.D. loc. cit. (*De Institutionibus* Lib. XIV.):—

“Primus Echionii palmes se jungere Bacchi  
Novit et externo tenditur uva mero.  
Nexilibus gemmis fœcundos implicat artus  
Vitis et amplexum pascit adulta genus  
Degenerisque comæ vestigia mitis inumbrat  
Pampinus et pingui curvat onusta deo.”

† *Lucius Junius Moderatus* Columella, (2 B.C. 65 A.D.) loc. cit. (*De Arboribus* Lib. XXVI.):—“Ex qua arbore inserere voles, in ea querito novellos et nitidos ramos. In his deinde observato gemmam quæ bene apparebit certamque spem germinis habebit; eam duobis digitis quadratis circumsignato ut in medio gemma sit et ita acuto scalpello circumcidito, delibratoque diligenter ne gemmam lædas. Deinde in qua arbore inserere voles, in ea nitidissimum ramum diligito et ejusdem spatio corticem circumdito et materiam delibrato et in eam partem quam nudaveras gemmam hanc quam ex altera arbore sumpseras aptato ita ut emplastrum circumcisæ parti conveniat. Ubi hæc feceris, circa gemmam bene vincito ita ne lædas; deinde commissuras et vincula luto oblinito, spatio relicto quo gemma libere germinet. Post unum et vigesimum diem. solvito emplastrum.”

‡ *Marcus Terentius* Varro, born at Fan in 118 B.C. loc. cit. (*De Agricultura* Lib. XLI.):—“Itaque vitem, triduo antequam inserunt, desecant ut qui in ea nimius est humor diffluat antequam inseratur. Aut in qua inserunt, in ea, paulo infra quam insitum est, incidunt unde humor adventicius affluere possit.”

§ *Marcus Portius* Cato, born at Tusculum 234 B.C. loc. cit. (*De re rustica* Lib. XLII.):—“Quod genus aut ficum, aut oleum esse voles, inde librum scalp pro eximito, alterum librum cum gemma de eo fico quod genus esse voles, eximito; apponito in eum locum unde exsecaveris in alterum genus, facitoque uti conveniat. Librum longum facito digitos III. S. latum digitos tres. Ad eundem nodum ob linito, integro uti cœtera.”

agriculturists whose works we possess. Some of these authors even acknowledge that they drew their information largely from Magon of Carthage, who wrote an encyclopedia of agriculture in 22 volumes, 540 B.C., and Varro declares with remarkable honesty that he only abridged Magon's works.

After ten years' persistent efforts and successful experimentation in Europe, several new methods of grafting and budding above ground, applied to vines, seem to have almost reached perfection, and their use tends to become general, although they were at first condemned by viticultural authorities.\*

It is interesting to note that all the efforts made during the last ten years to perfect these methods tend, as they become successful, to identify themselves with methods already known to the ancients.

So far as our ignorance permits us to judge, budding and grafting methods as we know them were not invented in one day, but have simply reached their present stage, which has yet to be improved, by careful and reasoned observation and perseverance. It is only by consulting and studying the accumulated evidence of successes and failures of past generations, that more perfect systems will be found. In order to try and forward this final result, and induce vine-growers to experiment themselves, the different methods of grafting above ground (as described by their authors when possible) known and practised in Europe, have been collected and brought together under the present form, the object being to enable growers to study, combine and perfect them, and by making use of knowledge already acquired, discover or improve existing methods, or verify under varied conditions the results obtained by others.

RAYMOND DUBOIS.

W. PERCY WILKINSON.

Viticultural Station,  
Rutherglen, January, 1901.

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\* G. Foëx, *Cours Complet de Viticulture*, 3rd edit. 1891, p. 293.

## GRAFTING OF THE VINE ABOVE GROUND.\*

BY CH. TALLAVIGNES,

*Director of the School of Agriculture, Ondes,  
Haut-Garonne.*

The results (satisfactory in most cases) of the methods of grafting vines underground have prevented viticulturists from devoting attention to the grafting of the vine above ground ; it may also be stated that the methods so far known of this manner of grafting, even when placed in experienced hands, frequently resulted in failures.

This is so true that in 1886, Foëx stated in his lectures at the School of Agriculture, Montpellier, "Grafting above ground, which theoretically realizes the most favorable conditions (as a principle, the younger the stock the greater the proportion of strikes, and the better the knitting) has been abandoned on account of the rapidity with which the scions become dry. The latter, as a matter of fact, lose their vitality before knitting takes place unless kept in a hothouse."†

In recent years the idea of grafting above ground has been revived, and new practical methods of easy execution, giving almost certain strikes, have been devised. We will study these rapidly, leaving aside purely fancy grafts too difficult to perform, or those resembling the methods we are going to describe.

## INARCHING, OR GRAFTING BY APPROACH.

Until quite lately the only recommendable graft above ground was the graft by approach, which we will not

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\* Revue de Viticulture, vol. I., 1894.

† G. Foëx. Cours complet de Viticulture. 3rd edit. 1891, p. 293.





Fig. 1.—Preparation of Stock for the Graft by Approach.

describe, for it does not differ from the ordinary inarching, of which Hardy's opinion is—"An artistic method, but of little use."

The *graft by approach* is used to replace the occasional misses on the frame wood of cordons or spaliers. It consists in splitting the shoot along its axis, at the point where the scion is to be placed; a cut is made, varying in depth, reaching the pith, and sometimes the opposite side of the shoot. The scion is an elongated wedge, carrying one eye, cut in such a manner as to fit the slit exactly (Figs. 1, 2, and 3).



Fig. 2.—Graft by Approach. Front view of scion.



Fig. 3.—Graft by Approach. Side view of scion.

#### OTHER GRAFTS.

The *Boisselot* graft is an ordinary cleft-graft, in which the scion is placed in a slit made at the bifurcation of two shoots which are pinched. This graft may also be made at the axil of the spurs of a cordon.

The *Baltet* graft is a cleft-graft made at the axil of the eye of a shoot.

The *Alliès* graft is an ordinary whip-tongue graft, made on a green shoot, and prevented from drying by a cork ligature similar in every respect to the underground graft. Alliès has, at St. Antonin (Tarn-et-Garonne), successful instances of this method. We must acknowledge that we have had many failures with it. Even by protecting the joint with lead-foil, as recommended by Julien Daumas, we did not obtain better results.



## HUNGARIAN GRAFTS.

In Hungary the system of grafting vines above ground is current practice; the two methods used are the *herbaceous cleft-graft*, and the *flute-grafting* due to Professor Horvath.\*

These two methods are very well described by Jouzier, who was commissioned by the French Government to study and report on the viticulture in Hungary.† His report appeared in the *Annales de l'Institut National Agronomique*, vol. 12, 1887. We cannot do better than reproduce his descriptions:—

“The *herbaceous cleft-graft* is one of the oldest systems used in Hungary. Tschudy used this method, and recommended it. In a word, it is an ordinary cleft-graft made on the green shoots of very young vines. The shoot used as stock is cut between the second and third leaf (*a a'* Fig. 5) counting from the apex, and  $1\frac{1}{2}$  to 2 inches above the third leaf. The latter is pinched at *b b'*. The scion is a similar

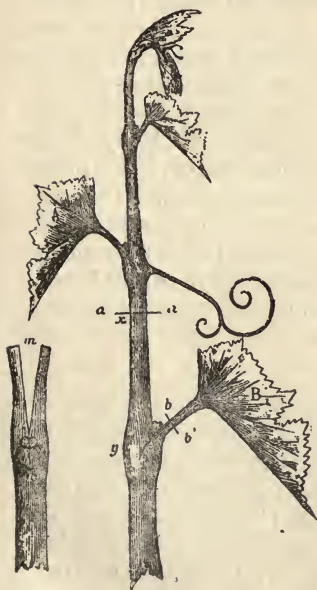


Fig. 4.

Fig. 5.

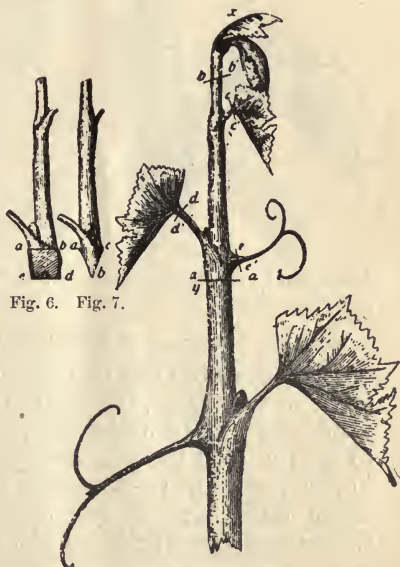


Fig. 6. Fig. 7.

Fig. 8.

\* Professor at the School of Viticulture, at Tarczal, Hungary.

† Late Professor at the School of Agriculture, Ondes; now Professor at the National School of Grand-Jouan.

shoot, the leaves of which are pinched (Figs. 6, 7, 8, and 9). The ligature used is wool or raffia.\* Knitting takes place rapidly. The ligature is removed directly it begins to cramp



Fig. 9.

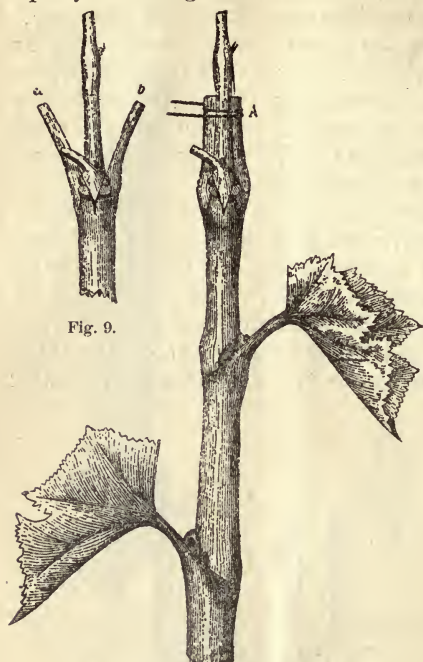


Fig. 10.

This mode of grafting is not new. It is very commonly used for fruit trees.

Jouzier describes it as follows :—

“To excise the bud one cannot proceed as in the case of apple or pear trees, the shoots of which are almost regularly cylindrical. The considerable protuberance which corresponds to each node in the vine necessitates the adoption of the following procedure:—A circular incision, penetrating the whole depth of the bark, is made  $\frac{1}{2}$  inch above the bud, and another the same distance below (*a a' b b'* Fig. 11), then right and left

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\* *Raphia* or *Raffia* is the thin strong cuticle of the leaf of *Sagus Raphia*, a palm, native of Madagascar; *Raphia Tœdigera*, a Brazilian species, is also exported to Europe and helps to make up the bulk of the raffia of commerce. [Transl.]

the joint. We will not describe it in further detail, as Figs. 4 to 10 explain it clearly.” Jouzier saw at Tarczal a whole vineyard grafted in this manner, which had a very satisfactory growth; but the danger of this graft drying, the necessity of decapitating the stock, and consequently the impossibility of making more than one graft on one shoot prevents us from recommending it.

The *flute-graft* recommended by Professor Horvath is more interesting. It consists in inserting a bud (scion) in place of an eye of the stock.

of the bud two longitudinal parallel incisions are made, bisecting the circumference (if anything towards the eye) and joining the annular incisions ( $x y$  Fig. 11).

"The bud so prepared, the next thing is to choose the position where it is to be placed. It should be placed on a shoot of the same diameter, as nearly as possible, as that from which it was taken. But the indispensable point which makes the difference between ordinary budding and Professor Horvath's flute-grafting is that the bud must be placed or inserted in place of another bud on a node.

"The green shoot to be used as stock having been chosen (Fig. 12), and on the latter the bud where the graft is to be made (A, Fig. 12), the leaf on that node is removed. Above and below the bud, at distances corresponding to the length of the scion, two semi-annular incisions are made ( $a a' b b'$  Fig. 12), penetrating the whole depth of the bark, without, however, cutting into the wood. A longitudinal cut ( $x y$  Fig. 12) is then made parallel to the axis of the shoot, passing through the whole bark, dividing the petiole in two without cutting into the wood. Then, with the haft or spatula of the grafting-knife, the bark is lifted on both sides of the cut so as to form, as in the ordinary budding, two flaps. These two flaps being open (Fig. 13), the wood is left bare, exposing a place the shape of which is arranged so as to be exactly adapted to the shape of the scion. The scion is inserted, the two flaps brought over it, and the joint ligatured (Fig. 14). The tie is made with wool or raffia, and a fortnight or twenty days later it should be undone."



Fig. 11.—Horvath method. Preparation of scion.

According to Professor Horvath, 80 per cent. of strikes have been obtained with this process. But the minutiae of this lengthy and delicate operation militate against its use



on a large scale.\* We are going to point out how much more easy, rapid, and practical are the following methods.

### SALGUES GRAFT.

This graft was originated by a carpenter, Mr. Salgues, of the village of Betaille (Lot), whose first trials were made on the 27th June, 1887. It is an ordinary budding, but

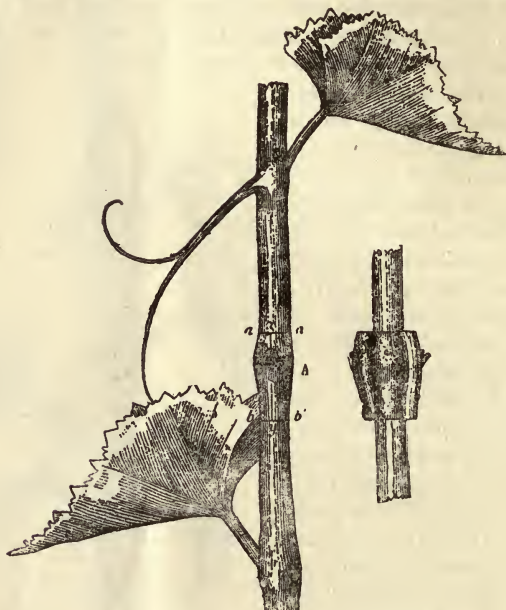


Fig. 12. Fig. 13.  
Horvath method. Preparation of stock.

so profoundly modified as to be entitled to be considered as a new method. We have seen the results of this method in a vineyard of four to five years old; the grafts were fine, the joint invisible, and could only be detected by a slight swelling at the point where the graft had been made.

On the other hand, many viticulturists have obtained unsatisfactory results with this method; this is due to the insufficient quantity of sap at the moment of operating, or to the bad selection of the scion-bud, or, again, through not

\* The Horvath method might be simplified by utilizing the simple longitudinal slit invented by Salgues. The bark on the side of the slit being lifted by bending the shoot inwards, the bud being introduced into the opening thus formed. Trials of this simplified Horvath method have been made at Ondes by Clarac.



observing certain precautions which are necessary, as we ascertained last year in the experiments carried out at the School of Agriculture, Ondes. Salgues' graft consists in fixing on a green shoot of the year an elliptic scion or shield carrying a bud at its centre (Figs. 17 and 18). On any internode of the shoot to be grafted, a longitudinal incision is made with the grafting-knife, penetrating the whole depth of the bark and of about the length of the shield (Fig. 15); with the haft of the grafting-knife the bark is raised on both sides of the slit; the shoot is then bent inwards and the lips of the slit open easily (Fig. 16), the scion bud is inserted in the opening, and the shoot left to spring up in its former position. The scion bud is then compressed by the bark, and the operation is completed by tying with wool, cotton, or raffia. The ligature should be removed a fortnight or twenty days after. This method, as may be readily seen, is much simpler than the Horvath process.

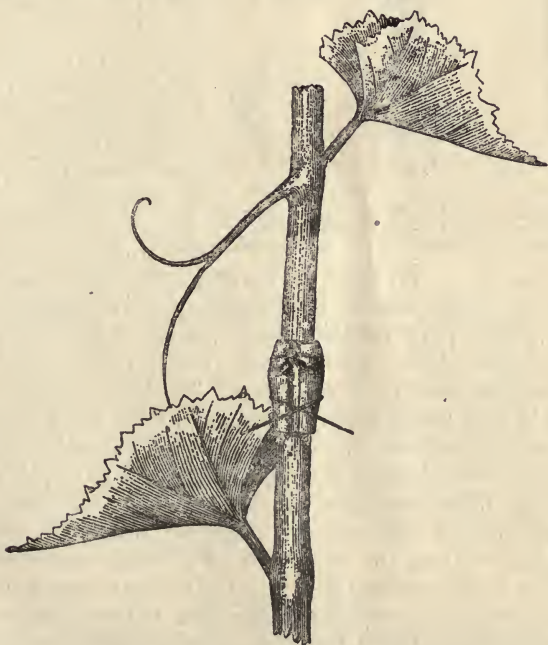


Fig. 14.—Horvath's graft finished.

For the Salgues graft to be a success it is necessary, firstly, that the stock should be in full sap, so that the lips of

the slit may be easily raised; secondly, that the scion-bud should be carefully selected. All the buds of a shoot cannot be used indiscriminately. When a green shoot is cut longitudinally on all its length different colorations may be noticed on the section; towards the apex, the shoot has not yet begun to lignify and the section is almost uniformly green in colour, only slightly deeper above or below each node, the diaphragm of which can only be detected at the second or third node

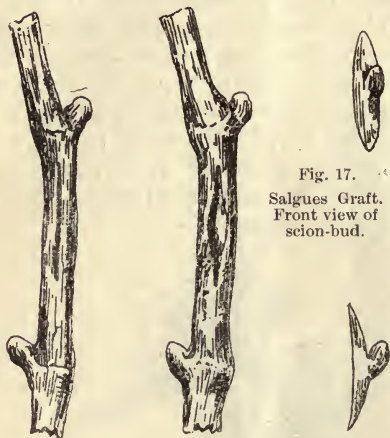


Fig. 15.—Stock of Salgues Graft prepared.

Fig. 16.—Same, bent inwards.

Fig. 17. Salgues Graft. Front view of scion-bud.

Fig. 18.—Salgues Graft. Side view of scion-bud.

(counting from the top), by a slightly lighter colour. If we examine the nodes downwards we see the diaphragms becoming more distinct; finally, still lower, the pith begins to be indicated by a whitish tint. At first, Salgues recommended the scions to be taken only from very tender buds in which the diaphragm was just beginning to show; he has found since, that it is preferable to choose riper eyes, in which the diaphragm is already well apparent. We are of opinion that we may safely choose all buds where the diaphragm is apparent, but taken on the part of the shoot where the white pith is not yet noticeable. Each shoot can, under these conditions, furnish two or three sound eyes for budding. We must evidently bring some attention to bear on the selection of the scion; however, one quickly learns to choose the right ones. This is a question of practice, difficult to explain without actual demonstration in the vineyard. Salgues used formerly to show my students a simple means for selecting these buds. When one tries to bend a young vine-shoot, the resistance is *nil* towards the top; the further we get from the apex the greater the resistance becomes, till we reach a point where the shoot, almost lignified, does not bend, but breaks. When the fingers can easily bend the shoot and feel a slight resistance, one is sure that the bud in that region, together with one above or one below, are suitable for the Salgues graft.

The necessity, in order to make a success of the Salgues method, of choosing stocks well in sap, and young shoots for selecting the buds, indicates the time at which this operation should be performed ; and May, June, and July are the most favorable months.\*

The Salgues graft may be performed on mother-stocks of American vines throughout the summer, as the shoots develop.

The graft is then made with what is known as a *dormant eye*. If we desire the graft to throw a shoot right off we should pinch the stem over it ; but it has been proved in practice that grafts made with *growing eyes* are inferior to those with dormant eyes.

It is necessary to tie the grafted shoots to a stake, as results from our experiments last year. We used the Salgues method and budded dormant eyes, 16 inches apart, on *Riparia* canes, with the object of obtaining grafted cuttings, which would have been eligible for planting out during the following spring. We made a contract for this operation with a very skilful horticulturist, Mr. Alazard, of Montauban, at the rate of 24s. per 1,000 grafts knitted. Mr. Alazard had previously undertaken, with great success, a similar contract with Mr. Cangardel, of Lot, on American vines trained on wire. At Ondes, the shoots of our *Riparias* were spreading on the ground ; the result was a failure. Notwithstanding the late season, the same grafts made on the *Riparia*, but tied up on stakes, had, on the contrary, a much higher proportion of takes. The grafts placed too close to the soil dried up on account of the heat rising from it.

Salgues' method of budding is one of the most interesting known—it gives perfect knitting, and is at present very generally used. Now viticulturists are not content with the application of this method for green shoots, and they graft green buds on old wood ; they have even gone further, and grafted on old wood, buds taken from canes stratified in sand for many months, and even then the grafts succeeded. Last year, when on a visit of inspection, we saw remarkable instances of this at Château de Croze, belonging to Mr. de Verninac, Member of the Senate.

#### BESSON GRAFT.

As we have seen, the Salgues scion is grafted on the internode of the shoot. The Besson graft, like that of Horvath, is inserted on the node itself. But, while the method

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\* About November, December, January, in Victoria.



of the Hungarian viticulturist is a true budding, that of Besson is an *inlaying*. Moreover, in the Horvath method, the graft is always made on green shoots; while, in the Besson system, it is performed with lignified wood.

The Besson graft, which was performed for the first time in the spring of 1893, has been described at length in this *Revue* by M. Mazade.\* We, therefore, reproduce his description in full:—

“The budding of vines by the Salgues system has often given satisfactory results, and even, under certain conditions, rendered real services. It has been used to graft afresh shoots grown from American vines on which the spring graft had missed. In this case, if the budding is done in June,† it gives birth to a strong shoot the same year. It is possible to graft the canes or shoots of American stocks during the whole summer with a series of buds distant from each other the length of an ordinary cutting. In winter, when pruning, the canes are cut above each graft, and by this means grafted cuttings are obtained. They simply require to be placed in the nursery the following spring. This graft is also used for the propagation of rare varieties.

“Summer budding is not always a success. The proportion of takes is very variable, and, what is more the operation is difficult. This is to be regretted, for this mode of grafting, almost the only one used for fruit-trees by nurserymen, presents very great advantages. It is very rapid, and the wounds are reduced to a minimum. It will, perhaps, be possible to facilitate and generalize this form of grafting for vines by the *inlaid budding* on lignified wood.

“The Besson graft was tried in the spring of 1893 at the School of Agriculture, Montpellier, in order to make grafted cuttings; it gave good results, the proportion of takes being 50 per cent. in a soil not favorable for a nursery, and which was only watered once during the summer.

“This graft was made at the same time as the ordinary bench grafts, in spring. It is performed in the following way with Besson’s grafting appliance:—This appliance (Fig. 19) is a kind of secateur, with curved blades perpendicular to the handles, and is used to make the cut and also to lift the bud. These two operations are practically identical, for when the cut is made a bud is lifted, and *vice versa*.

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\* *Revue de Viticulture*, vol. I., 1894.

† About December in Victoria.



The blades of the secateur are placed parallel with the axis of a shoot, at its middle and level with the bud. The lateral portion detached, must be a little under half the thickness of the shoot. The two handles of Besson's shears are brought together, and the cut thus made. This cut (Fig. 20 A) is regularly curved and concave; its length varies according to the size of the cane—it is about one inch long.

"To prepare the scion we operate in exactly the same way as with the stock, only, while in this case the cut is made on the second eye, counting from the top of the cutting, the scion is taken anywhere from the cane used as scion bearer. The scion-bud thus prepared (Fig. 20 B, C)



Fig. 19.—Besson's Grafting Shears.

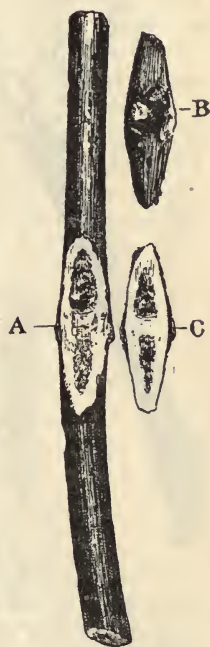


Fig. 20.—Besson Graft.

A, stock; B and C, scion-bud.

fits marvellously well, on account of its convexity corresponding exactly to the concavity of the stock. As it is the same blade which makes the two cuts, and as this blade is placed in the same way in both cases, the juxtaposition of

stock and scion is perfect. To attain this result one only requires to choose shoots of equal diameters.

"The cuttings to be grafted should be 16 inches in length; their top end should be limited by a bud cut half through. The graft is performed, as already said, on the bud immediately below the top internode, tied with raffia, and the grafted cuttings thus obtained placed in the nursery. They should be carefully earthed up so as to cover the scion with about  $\frac{3}{4}$  inch of soil. The only operations necessary after this are a few waterings between the lines in summer, and frequent hoeing, being careful, however, not to uncover the grafts. Two months after planting the mound is brought down, and the roots growing from the bud removed. The mound is then reformed to prevent desiccation. In September\* the grafts are left bare to induce the knitting tissue to lignify. Finally, the care to be given to a nursery of Besson grafts is exactly similar to that required for any other nursery of grafted cuttings.



Fig. 21. — Besson Graft knitted.

"This graft gives very good joints (Fig. 21), and is certainly a very interesting application of *inlaid budding* to vines. If it were possible to make this graft in August or September† on lignified canes of American stocks, by surrounding the joint with rubber lacing, one might place buds all along the canes, and obtain, by this means, at the pruning season, cuttings bearing buds of European varieties. The Besson budding tried in this way has not given satisfactory results. If the budding made in August or September† gave a good proportion of strikes, it might, on account of the facility of its execution enter into current practice, and constitute an excellent method of grafting vines."

\* About March in Victoria.

† About February or March in Victoria.

## CLARAC GRAFTS.

While Besson was experimenting upon the inlaid budding of vines, Clarac, the Demonstrator of Horticulture at the School of Agriculture, Ondes, was applying the same idea; but, like Besson, whose work he was unaware of, stopped by the difficulty in excising the bud, he resolved the problem in a different manner. Although the Clarac grafts have a point in common with that of Besson, that is to say, the substitution of one bud by another, by inlaid budding, they differ from it in so many details, that they constitute a new method of grafting vines, and by no means the least interesting.

*Clarac's First Method.—Stock.*—A bud is removed from the stock and replaced by a scion-bud. An incision is made on the cane  $\frac{1}{16}$  to  $\frac{1}{8}$  inch above the bud to be removed with an ordinary grafting-knife, or one with a curved blade for preference (Fig. 22), the incision is continued in a straight section parallel to the axis of the cane, penetrating only one-third of the diameter. To operate with success the first finger of the left hand is placed under the eye of the bud. The cut is stopped when its length is a little over the width of the blade, under the base of the bud (Fig. 23).

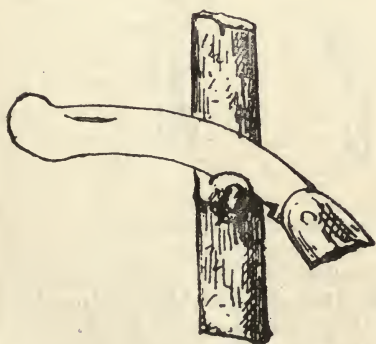


Fig. 22.—Clarac's First Method. Preparation of Stock.

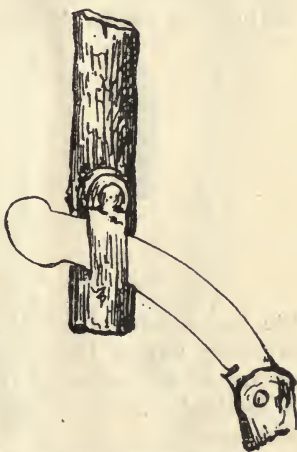


Fig. 23.—Preparation of Stock.

The blade is then removed from the incision, and laid flat on the cane immediately under the base of the bud (Fig. 24), the width of the blade indicating the point



where the new incision is to be made (Fig. 28) transverse and oblique to prevent the first section from spreading, and to make a strong notch for the scion to rest upon.

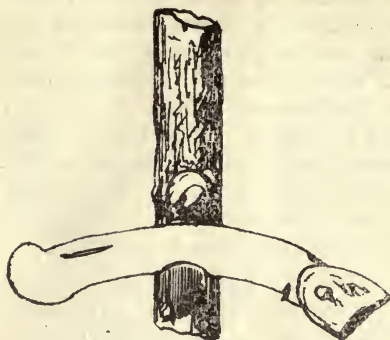


Fig. 24.—Preparation of Stock.

*Scion.*—To excise the scion-bud, one operates exactly as above described (Figs. 25, 26, and 27). It is then inlaid in place of the bud removed from the stock and ligatured with wool, raffia, or string. Fig. 29 shows the graft when finished.

*Clarac's Second Method.—Stock.*—Instead of removing the bud, a cut is made parallel to the axis of the shoot at about one-third of its diameter in depth, the cut starting about  $\frac{1}{16}$ th inch above the bud, and ending  $\frac{1}{3}$  in. below (Fig. 31).

*Scion.*—The scion-bud is excised in the same manner as for the above method, with this difference only, that



Fig. 25.  
Scion, Front View.



Fig. 26.  
Scion, Side View.



Fig. 27.  
Scion, Back View.

the bevel formed by the transversal and oblique section must be longer than in the first method (Fig. 30). This scion-bud is inserted in the slit prepared on the stock. It is to facilitate the insertion of the scion that a longer bevel is advocated.

A ligature of raffia or string is made, being careful to begin above the eye or bud.

The bud A (Fig. 32) constitutes a sap-drawer, which facilitates the knitting of the bud B. When knitting has taken place A is disbudded.



The second method is more rapid than the first. In both cases the ligature must be cut away three weeks after being made. Waxing these grafts is not indispensable, but is useful, and should be done when possible. The success obtained by Clarac is perfect. Of all the methods above described, the two due to Clarac are certainly those which seem most worthy of the attention of viticulturists wishing to perform aerial grafts on vines. They are easily executed and may be applied to herbaceous, lignified, young or old shoots.

Herbaceous grafts made with dormant buds last July\* are already forming many leaves.

Grafting above ground for vines may render great services, for changing the nature of the vines in a vineyard, to produce grafted cuttings, and even to perform the ordinary grafting of rooted stocks. It also renders the training of vines in cordons easier, as it allows us to replace a bud which, dying off, might ruin the foundation of the future cordon, or form interruptions.

Changing the nature of a vineyard without losing a crop becomes very easy with the Clarac grafts. If the vine is trained in the gooseberry-bush method, buds are grafted on two or three spurs, according to the strength of the

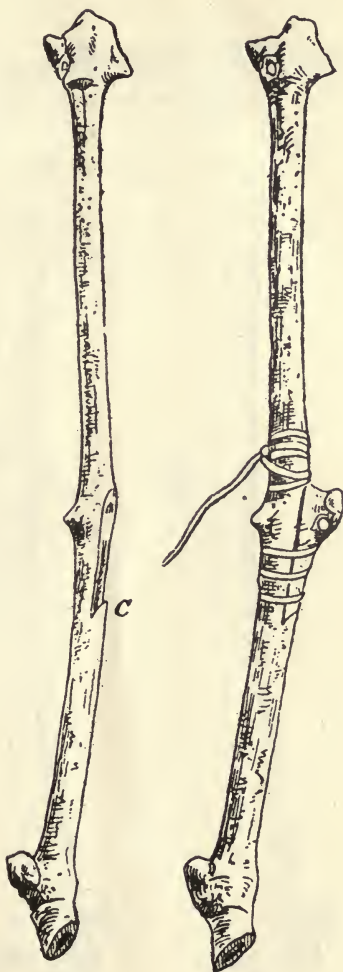


Fig. 28.  
Clarac's First Method.  
Stock ready to be  
Grafted.

Fig. 29.  
Clarac's Graft  
finished.

\* About January in Victoria.

stock, while the other spurs continue to produce fruit. If the grafts knit well, the following year the spurs of the stock are removed, and the grafted spurs alone preserved. If the vine is trained according to the Guyot method,\* a bud is grafted on the two eyes spur; if the grafted bud knits, the other is disbudded; if it does not, the same operation is begun again the following year, or the Clarac graft may be performed on the green



Fig. 30.—Bud of Clarac's Second Method.

shoot springing from the second bud of that spur. However, the shape of the vine need not be injured. Bench grafting, in view of obtaining knitted rootlings, is very rapid with the Clarac method. One may also, as in the case of the Salgues method, bud on canes of a stock nursery, 16 inches apart, with dormant eyes.

Cuttings made from these canes, planted out the following spring, will furnish excellent grafted cuttings.

Finally, the Clarac method is used for the so difficult multiplication of *Berlandieri*; for this we make a one-eyed cutting of *Riparia* or *Rupestris*, but replacing the eye with that of a *Berlandieri*.



Fig. 31.—Clarac's Second Method. Stock ready to be grafted.

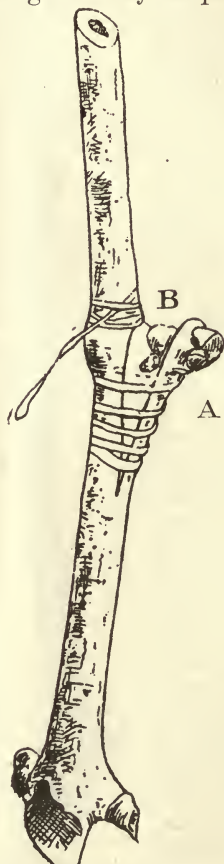


Fig. 32.—Clarac's Graft finished.

\* Spur and long rod system.

Fig. 33 shows one of these one-eyed grafts ; the success with this method of multiplying Berlandieris is excellent ; shortly after planting out, the Berlandieri throws roots from the joint of the graft, and, after having been nourished by the fragment of Riparia or Rupestris, soon feeds with its own roots.



Fig. 33.—Berlandieri Bud on Riparia one-eyed cutting.

This application of the Clarac graft will render great services in the Charentes and Champagne, for it will enable vine-growers to obtain Berlandieri cuttings at moderate prices.

## VOUZOU GRAFT.\*

BY B. DROUHAULT,

*Departmental Professor of Agriculture, Lot.*

The grafting of vines is such an important question, from the point of view of the vitality and the durability of our vineyards, that one cannot seek for too great perfection as well as facility of execution.

We know, as a matter of fact, that apart from the question of affinity between stock on scion, it is the perfection of the joint which insures the longevity of the grafted vine. A badly knitted graft may give vigorous shoots during the first years, but soon after, when the non-adherent parts develop, the plant becomes sickly and quickly dies. The dying off of many grafted vines is generally attributed to more or less defined phenomena, while it is simply due to bad knitting. The English cleft graft and the whip-tongue, which are almost alone used nowadays, possess the peculiarity that many joints which at first seem good, are incompletely knitted, and later on give sickly plants. The favour with which the Salgues graft was welcomed by many viticulturists showed how much we were impressed with the defects of all the systems so far applied, and how urgent it was to find a better method. Unfortunately, the Salgues method, which consists of grafting a green bud on a green shoot, excellent in theory, of easy execution, and upon which great hopes were founded, has against it two great causes of non-success which have limited its application.

The choice of the point where the graft is to be made on the green shoot is one of these causes, but by far the most important is the choice of the scion-bud. For success to be assured, it is necessary for this scion-bud to be in a peculiar state of development difficult to characterize theoretically. It is only after long experience and many failures that one acquires exact notions of that state of development. Salgues, it is true, tried to fix it by saying that the bud must be "two-thirds green," that is to say, one-third of the wood

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\* *Revue de Viticulture*, vol. IV., 1895.



only being formed, but these indications are not precise enough, or, better, do not convey any sufficiently definite meaning to the majority of viticulturists.

It is easy to explain, under these circumstances, the numerous failures which followed its application in inexperienced hands, and why it was discarded by many viticulturists. That is why this method, which, however, gave good results in the hands of its inventor and a few skilful operators, has not been so generally applied as would have been thought from its inherent qualities. Salgues, after four years' experimenting, in 1891, hoping to render his method of grafting more readily utilizable, and also to study one of the causes of its failures, attempted to graft green buds on wood from one to three years old. The success which he personally obtained was again very satisfactory, and continues to be so in his own vineyard and those of a few other vignerons, particularly at that of Lemarchand, of Pradet (Var), where M. Cahuzac, who began the application of this system in 1892, obtained excellent results, which he lately published.

Notwithstanding the modification which allows us to graft on young or old wood, according to circumstances, the use of the herbaceous graft has not much extended. This is due to the main cause of failure subsisting, the difficulty of choosing the scion-bud.

Another vigneron of the Lot overcame this difficulty, and rendered this method of grafting essentially practical for everybody, with the same chances of success, by practising lignified budding, which he named "*normal budding of the vine*." In 1891, Vouzou, a vineyard labourer at the Château of Crozes (Lot), tried successfully to replace the herbaceous bud by a completely lignified one taken

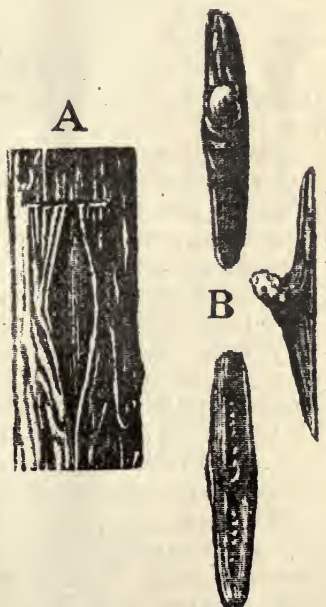


Fig. 34.—Vouzou Graft:—A. Stock ready to be budded; B. Front, side, and back view of shield.

from a cane of the previous year preserved in sand. This graft does not differ much from that generally adopted for fruit trees, hence its name.

On a part of the stump (stock) above ground, and on a part deprived of nodosities, where the liber fibres are almost straight, a T-shaped incision is made through the bark, the sides of which are raised with the haft of the grafting-knife (Fig. 34 A).

The scion is taken from a cane of the previous year's growth, of medium size (Fig. 34 B), cut before the eyes start to burst, and preserved in sand in the same way as is done for the scions of the whip-tongue grafts, until the time of grafting. One has not, therefore, to be pre-occupied in this case by the peculiar state of development of the bud, as is the case for the herbaceous graft. It is necessary, however, to use only well-constituted and well-preserved eyes of healthy appearance.

The scion-bud is excised in the same way as is done for fruit trees, with the only difference that under the eye a thickness of wood is left reaching the pith. One should even leave some pith under the eye. This does not seem to present much difficulty. It may, perhaps, be more clearly understood when we say that the scion should be at least 1 inch in length, and that the section opposite the eye must be flat.

After inserting the bud thus prepared in the incision under the bark of the stock, it is bound firmly with raffia (Figs. 35 and 36), wrapping as close as possible to the eye, without, however, crushing it. Wool has been tried for this purpose, as in the case of the herbaceous graft, but has not been found superior to raffia.

To insure knitting, the shoots of the stock must be pinched very short. The scion then knits quickly and gives a vigorous shoot, lignifying easily before winter, and upon which the pruning system is started the following spring. A fortnight to twenty days after the execution of the graft, it is easy to ascertain whether it is knitted, but the tie should only be cut one month later, and on the side opposite the scion.

This graft may be made during the whole period that the sap is circulating, during which the bark is easily detachable from the wood. In our region (Lot) this lies between the 15th May and 15th July.\* After that date, even admitting

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\* November to January in Victoria.

the possibility of making this graft, it is to be feared that the shoot would not have time to lignify, and the trials of this method with dormant eyes have not been successful.



Fig. 35.—Vouzou Graft,  
before tying.

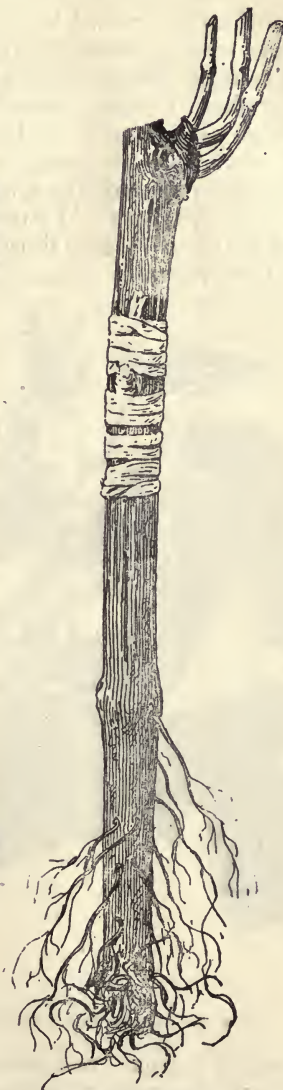


Fig. 36.—Same, after  
tying.



Performed under the above-mentioned conditions, the normal budding gave excellent results to its inventor and all the vignerons (quite numerous) who, following his example, have applied it during the last two years. The proportion of takes reached between 75 and 100 per cent. in 1893, during which year the drought was of intense and long duration, causing failures with all the herbaceous and ordinary grafts. Vouzou obtained 90 per cent. in a lot of 1,000 grafts. We must add that last year at the State nursery, where the above-mentioned workman (Vouzou) publically demonstrated his system, the strikes reached 95 per cent. on twelve years' old stumps of *Cynthiana*; this year these grafts (Fig. 37) are simply excellent, vigorous, and bearing a few grapes.



Fig. 37.—Vouzou Graft:—A. Knitted Bud; B. Stock.

This graft is not only remarkable for the simplicity of its execution, and the great proportion of strikes resulting, but also from the point of view of the knitting. The examination

of sections, made perpendicular to the axis of the joint, shows that the knitting is generally perfect, the adherence of the ligneous part is almost as complete as in the herbaceous graft, and much more complete than in the ordinary cleft or whip-tongue graft.

The Vouzou method possesses, therefore, every advantage. It satisfies all the conditions of a good strike, and, at the same time, embraces the long recognised value of budding ; it avoids the majority of causes of failures pertaining to the methods previously used. And, moreover, we cannot too strongly emphasize the practical facility of its execution for the layman.

Its qualities and principal advantages may be recapitulated as follows :—*1st.* Extremely simple execution, easy of performance by any workman. *2nd.* Almost absolute certainty of a high percentage of strikes, for there is no danger of desiccation of the bud by hot dry winds. *3rd.* Perfect knitting and complete adherence of wood. *4th.* It is the only method of grafting vines of from one to twelve years old or more without decapitating the stock, or damaging its base. *5th.* In case of failure it is easy to begin again during the same or the following year, and it enables us to preserve a part of the crop of the stock during the year of grafting. *6th.* It allows us to graft several buds on a given vine without interfering with the shape, which increases the chances of success.

On account of the facility with which it can be performed on stocks of one to two years of age, or even on canes of the previous year's growth, preserved on the mother-vine with the object of obtaining grafted cuttings, we cannot too strongly recommend it, for trial at least, to all viticulturists. Without assuming that it will be substituted in every case for the methods in actual use, we are convinced that it is called upon to considerable expansion in the grafting of established vineyards and nurseries, and that it will render very great service to viticulture.

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## MEANS OF INCREASING THE STRIKE OF HERBACEOUS GRAFTS.\*

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BY CH. TALLAVIGNES,

*Director of the School of Agriculture, Ondes.*

In a series of articles published in the *Revue de Viticulture* of 1894 we described the principal herbaceous grafts of the vine. Since that time we have pursued our studies at the Agricultural School, Ondes, with the object of ascertaining the causes influencing the strike of herbaceous grafts. We now intend giving the results of experiments made by Clarac, the manager of the school.

1st. *Herbaceous Grafting. Selection of shoots bearing buds best fitted for scions.*—Among all the shoots growing on a vine stump some are better suited than others to furnish scion-buds. We should always choose branches growing from eyes which would have normally remained dormant till the following year, in preference to branches growing from buds bursting normally. Shoots of medium or rather small diameter are to be preferred. These shoots will furnish the scion-buds, which are to be grafted on to the old wood. The diameter of the shoots from which the scion-buds are excised must always be less than those upon which it is to be grafted. The best shoot to use is that developed in the shade, that is to say, sheltered by other shoots. Branches exposed to direct sunlight must always be rejected. The colour of the shoot is also of certain importance ; it should be light green, but not yellow.

The petioles of the leaves of the shoot should be of a whitish green, even a little pinkish, slightly transparent at the point of junction with the limb. Shoots bearing leaves with deep green, or red petioles, and non-transparent, must be rejected. The eyes of the extremity and base of the shoot, together with those placed at the base of leaves having a petiole too slender or too long, should not be used.

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\* *Revue de Viticulture*, vol. V., 1896.



2nd. *Preparation of scion-bud.*—Many operators, before cutting the scion-bud, begin by cutting the petiole of the leaf F, as close as possible to the bud B, placed at its base in *a a'* (Fig. 38). Many failures in herbaceous grafting are simply due to this defective method. Clarac has made a whole series of interesting experiments on this subject. In the first group of experiments, the petiole of the leaf was cut as close as possible to the bud B, at *a a'*; success middling.

In the second group the petiole was cut at *b b'*, at about half its length; numerous failures. In the third group, the petioles and the limb of the leaf F were left intact; complete failure. Finally, in a fourth group the whole of the petiole was preserved and a part of the limb *c c'*, only left attached to it. It was about  $\frac{1}{2}$  inch in diameter; almost complete success (Fig. 38).

These curious results may easily be explained. In the first series the section of the petiole *a a'*, determines the surface evaporation very close to the scion-bud B.

The latter therefore desiccates before having had time to form its knitting cambium.

In the second series

of experiments the petiole was cut further away from the bud B; but as this petiole is formed of a very vascular tissue, the desiccation took place rapidly, and communicated itself to the bud before it had time to knit. In the third series of experiments the limb of the leaf was entirely preserved, forming a large surface of evaporation and respiration, and the bud B was destroyed, not being able to furnish the leaf with the necessary nutritive element before the knitting took place. In the fourth series of experiments, on the contrary, the portion of the leaf preserved was not large enough to cause very great evaporation, and yet was enough to prevent the immediate desiccation of the petiole, and therefore that of the bud before the knitting was completed.

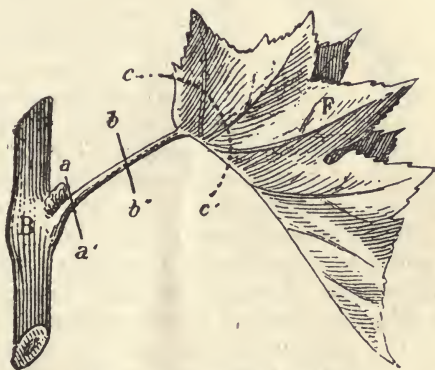


Fig. 38.—Preparation of scion-bud.

*Methods of excising the bud.*—Once the shoot has been selected, and those eyes not fulfilling the required conditions removed, the scion-bud has to be excised. On this subject Clarac has again made interesting experiments.

*First method.*—*Scion-bud with sap-wood* (Fig. 39.) This graft can only be made by selecting scion-buds on shoots of a small diameter, and grafting them on graft-bearing shoots of larger diameter. The sap-wood of the shield does not knit, therefore it is advisable to diminish its surface. To excise the shield, the shoot is seized with the left hand, the first finger being under the bud; the cut is begun with the base of the grafting-knife  $\frac{1}{2}$  inch below the bud, and, while cutting, the blade is drawn in such a way that the end section ( $\frac{1}{2}$  inch above the bud) corresponds with the point of the blade. The shield detached in this manner will be about  $1\frac{1}{4}$  inch in length; but the wood being generally chipped on the edge, it is advisable to level and smooth the section with a grafting-knife. By doing so the length of the section is reduced to one inch. The scion-bud is then rather thick at its centre, and terminated by two pointed bevels.



Fig. 39.  
Shield with sap-wood.

If the diameter of the scion-buds is large (diameter determined by the size of the bud) it will not fit well on the cylindrical internode of the stock; the sap-wood of the shield is therefore slightly hollowed with the rounded part of the grafting-knife, so as to make the concave surface fit perfectly round the stock. This method of budding can only be used during the first days of June.\* Later on these grafts apparently knit well; but the shoots have not time to completely lignify, and are then killed by frosts.

*Second method.*—*Scion-bud with half sap-wood, with the upper portion hollowed out* (Fig. 40). This method of preparing the scion-bud is far superior to that above described. The shoot bearing the eye which is to be excised is taken in the left hand in such a way that the extremity of the shoot faces the body of the operator (Fig. 41). The cut is started with the base of the blade of the grafting-knife  $\frac{1}{2}$  inch above the eye, while the blade is drawn outward as before, so as to

\* About December in Victoria.

reach the extremity of the section  $\frac{1}{2}$  inch below the bud with the point of the blade. The blade is then taken out of the section, and a transversal section, TT' (Fig. 42), made level with the longitudinal section so as to cut through the bark only. The bud is then seized between the thumb and first finger of the right hand near TT' (Fig. 43) and lifted. If we continued to lift the bud, the sap-wood which has been cut in TT' is completely separated from the bark of the bud, and the latter would be completely hollowed. It is therefore necessary, when the bark has been separated from the sap-wood up to the level of the bud, to draw the bud slightly towards the operator (Fig. 44). The tongue of sap-wood MM' breaks level with the bud; a part of the sap-wood adheres to the scion-bud, the front portion remaining fixed on the shoot in the shape of a two-pronged fork (Fig. 45). The scion-bud is flattened, its base cut fresh, and the sap-wood smoothed with the rounded part of the grafting-knife. This mode of operating, which is very difficult to explain in writing, is very easy to perform in practice. It certainly is the most rapid way of excising the scion-bud. Sometimes, when the shoot is too tender and the buds very close together, the sap-wood, instead of



Fig. 40.—Shield with half sap-wood.

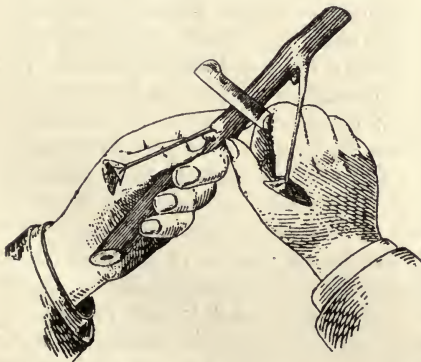


Fig. 41.

Preparing the bud. First operation.

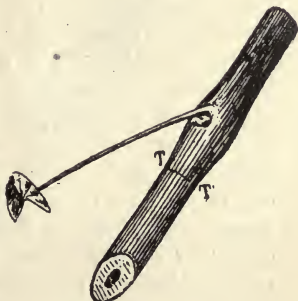


Fig. 42.

Second operation.



remaining on the shoot in the shape of a fork, breaks at the diaphragm; in this case the broken part on the scion-bud is

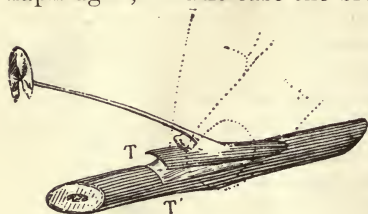


Fig. 43.—Lifting the shield.

smoothed and slightly cut at a bevel with the rounded part of the grafting-knife, being very careful not to touch the bark. This scion-bud enables one to make herbaceous grafts during all the time that the vines are in sap; it has the

great advantage of allowing the graft to lignify as quickly as the wood of the graft-bearing shoot, and gives perfect knittings.

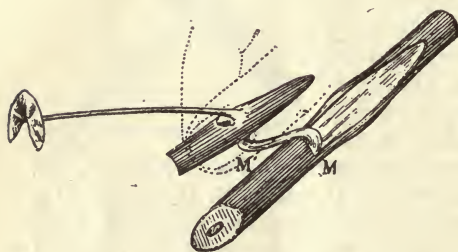


Fig. 44.

Drawing the shield towards the operator.

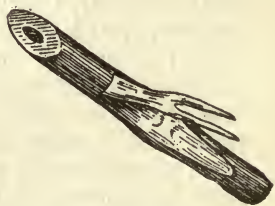


Fig. 45.

Fork of sap-wood remaining on the shoot.

*Making the slit on the graft-bearing shoot.*—This slit may be made in the shape of a T, or reversed T; however, with the half sap-wood shields it seems preferable to use the ordinary T slits. The T-shaped slit is easier to make than the longitudinal one, and facilitates the introduction of the scion. The point where the slit is made on the grafting-shoot does not seem to have very great importance; grafts have succeeded on all parts of a shoot; however, if we have a scion-bud with a little sap-wood attached to it, it is preferable to place it on the flat part of a shoot, as in that place the bark is thinner. This is not of very great importance if the ligature is well done. When the scions are placed on a cane one or two years old (these grafts succeed very well on old wood), the operator should look for the rounded part of the cane, for there the bark is thicker, and, as it is fleshy, desiccation is not to be feared. On old wood the bark is so very thin on the flat side that it is almost impossible to lift it.

*Ligatures.*—A ligature must fulfil several conditions; it should hold the two flaps of the bark of the shoot upon the scion, so as to preserve the latter in a fresh state as long as possible, and should make the scion fit tightly against the sap-wood of the shoot and prevent it from being displaced during the whole time necessary for the knitting to take place.

Wool, which has been extensively used, would make a good ligature if it did not dry the edge of the flaps; however, it has sometimes given very satisfactory strikes.

Clarac tried, at Ondes, a ligature which gave him very good results, but is perhaps rather complicated. It consists of a first binding of rubber tape, over which the ligature is made with wool. The rubber is cut in bands 8 inches long and  $\frac{1}{5}$  inch wide; the strands of rubber are superposed, and the strand of wool wound over it. The rubber breaks in places very easily, and the object of the wool is to keep it in place. This ligature is too expensive and too complicated to be used on a large scale, and is only interesting from an experimental point of view.

The best ligatures for grafts above ground are those made of lead or tinfoil (as already used for grafts underground) covering the whole scion, leaving the eye and petiole alone free; raffia is wound over the foil. It would be preferable to use wool when the graft is made on vigorous shoots, increasing rapidly in diameter (Fig. 46). The lead or tinfoil is cut in lengths of from  $\frac{3}{4}$  to 1 inch wide, and 2 to 4 inches long. Clarac obtained with this ligature at the school of Ondes a strike of 90 per cent.! Before making the ligature it is necessary to ascertain whether the scion adheres well to the stock—this is done by pressing the thumb below and above the bud.

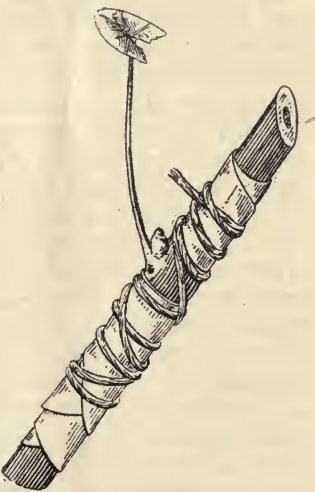


Fig. 46.—Ligature.

*Best Time for Grafting above ground.*—With the half sap-wood scion-bud, grafts have succeeded in June, July, and August\*; with the first method described between the 15th May and the 1st of June only.

\* About December to February in Victoria.

The above experiments show that herbaceous grafting and grafting above ground have become very practicable, and have rendered very great services. No other system can give as fine grafts, or as perfect knittings. It will be invaluable for changing the cépages of a vineyard without interrupting the crops. It gives perfect grafted rootlings by placing buds on the shoots or mother plants 16 inches apart the previous year.

It allows the replacing of missing or badly-placed eyes in the cordons of the Royat method. Finally, it allows better than any other system the multiplication of Berlandieri for grafted rootlings, and now that this mode of multiplication is generally coming into use everywhere and is described by viticultural professors, we may be allowed to repeat what was said in 1894 :—"The success with this method of multiplying Berlandieris is excellent; shortly after planting out, the Berlandieri throws roots from the joint of the graft, and, after having been nourished by the fragment of Riparia or Rupestris soon feeds with its own roots. This application of the Clarac graft will render great services in the Charentes and Champagne, for it will enable vine-growers to obtain Berlandieri cuttings at moderate prices."

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## BUDDING ON THE VINE.\*

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BY M. ALAZARD.

Budding on the vine, considered for a very long time as impossible or very difficult of execution, has now become a very practical system of grafting, owing to a more precise knowledge of its mode of execution, and gives perfect knittings; it is attractive in the extreme, and its only fault is that it was discovered too late. Fifteen years ago it would have supplanted the English cleft or whip-tongue graft. The success of this mode of grafting is mainly due to the initiative of a small viticulturist of the Lot (Salgues), who was the first to prove its practical utility, and obtained very satisfactory results with it. There is not another instance in which such a useful innovation has been more vigorously criticised or even combated. After Salgues had given several demonstrations of this system in many of the viticultural regions of France in 1891, numerous trials were made by viticulturists, who, not having succeeded the first time, rejected it, without trying to ascertain the causes of their non-success. Others deprecated and rejected the system without even giving it a trial, which naturally did not forward its general practice. When we first tried ourselves to practise budding on the vine, we met with many failures, and were also very nearly discarding it. All our scions during the first days of their grafting seemed to remain green, and the buds even seemed to start to swell, as if the knitting had already taken place. This was only a delusion, and almost invariably resulted in deception. At the tenth or twelfth day after the operation the scions suddenly dried up; we could not explain the cause of this failure. But at every new trial we obtained some strikes, and this fortunately induced us to renew our experiments (if 10 per cent. of the scions strike, there is no reason why 100 should not succeed), and so we were encouraged in continuing our experiments. So far we had followed Salgues' directions to the letter, *i.e.*, "that the scion must be taken from the most herbaceous part of the shoot towards its extremity," and we had seen Salgues following this principle at the Government experimental nursery at Cahors.

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\* *Revue de Viticulture*, vol. VI., 1896.

On the 18th of July, 1891, that is to say, after two months of fruitless trials, suspecting that the scions which had struck must present some peculiar conditions of constitution, we decided to place 100 buds on fine shoots of a Riparia mother plant, taking all the buds of a Malbec shoot. We labelled each of these scions, mentioning on the label—1st. Its state of lignification; 2nd. The thickness left under the bud; 3rd. Its order on the shoot; 4th. If it were or were not accompanied by a small latent axillary bud. We then waited with great anxiety the critical twelfth day; we were unable to visit the grafts before the eighteenth day. At last we were satisfied that those which were perfectly well knitted belonged to the central portion of the scion-bearing shoot, free from latent axillary buds, and of a semi-ligneous constitution at the time the graft was made; on the contrary, those originating from the upper third of the scion-bearing shoot (therefore too herbaceous) had become black, and died. Since that time we have not had any failures, and have found the truly practical conditions for budding, which we have used since with great success. As we do not desire to make a secret of this method, and realizing the services it may render to viticulture, we will describe its means of execution.



Fig. 47—Knitted Bud (twenty days after budding).

### GREEN BUDDING WITH DORMANT EYE.

*I.—Time of Budding.*—Vines may be budded from the 1st of May to the 15th of August\* according to climates. In the warm regions of the south of France the early bursting of the buds enables one to obtain good eyes for budding at the end of May and the beginning of June; while, in the south-west regions, it is only on the 10th of June that the buds show characters of vegetation retarded enough to give good scions.

*II.—Stock.*—The stock may be a shoot growing on the American mother-plant, or rootlings one, two, or three years

\* About November to February in Victoria.

old. If we have to deal with herbaceous shoots, scions may be placed at from 12 to 14 inches apart, in such a way that from a single shoot of *Riparia Gloire*, for instance, we may, when the pruning season comes, gather a certain number of cuttings, already bearing perfectly-knitted scions far superior to the best English-cleft graft. Certain *Riparia* mother-plants three years old, disbudded, stripped, and trellised on stakes or wires, gave up to 135 grafted cuttings, which already have almost completely rooted and bear shoots from 10 to 14 inches in length. This is an important fact considering the dry spring we are having this year.

Instead of placing buds on a herbaceous shoot, we may also graft rooted stocks from one to three years old, or even cuttings without checking their growth in any way, for nothing is suppressed when the grafting is performed (Fig. 48).

It is in the latter cases more especially that the utility, economy, and security of this method is shown. We say security, because if the grafting does not succeed the first time (this can be ascertained ten or fifteen days after grafting) the operation may be repeated on the shoot of the stock, a little above or a little below the point chosen in the first instance.

If, in these operations, the necessary care, as explained hereafter, is taken, we will always find in autumn a larger percentage of strikes than with any other method; in any case, if the grafts have missed, the stock remains intact, and may be grafted



Fig. 48.  
Grafted Cutting at the autumn  
following plantation.



by the English-cleft or Cadillac method, or budded with growing eyes or other new methods which we will consider later on.

*III. Selection of Scions.*—As we have seen above, the success of this new method lies almost entirely in the selection of the scion-bud.

Therefore, we must take from the European varieties we desire to multiply, axillary shoots in preference, that is to say, buds which have grown at the axil of an adult leaf, such as are found on shoots submitted to pinching. They must, as far as possible, have ceased to grow (which can easily be ascertained by the absence of terminal tendrils), and bear spherical buds well out of the bark, and free from latent axillary buds. The leaves must be cut off at about  $\frac{1}{2}$  inch from their base. If the shoot bears from five to six eyes, ordinarily from two to four of these possess the qualities of good formation required.

*IV. Excising the Bud.*—

The buds are excised with an ordinary gardener's grafting-knife, with as keen an edge as possible, and kept very clean; the section beginning at about  $\frac{1}{2}$  inch above the eye. The cut is made to a



Fig. 49.—Graft made on old wood.

A. Callus of the bud.

third or half the diameter of the shoot, and terminated at from  $\frac{1}{2}$  to  $\frac{3}{4}$  inch below the fragment of petiole preserved.

This being done, the operator holds the scion by the petiole, and ascertains first if the internal section is well outlined by a double line composed of the bark and the first layer of sap-wood; second, that the centre of this double line is well

filled with a flabby, greenish substance, divided by a transversal white line opposite the bud ; this is the rudimentary diaphragm. At the worst, the lower bevel of the scion may be a little more ligneous than the upper, but it is very important that the flabby matter be present in the latter.



Fig. 50.—Bud Grafted on the Spur of a Cordon of Jacques.

A. Callus formed by the Bud.

*V. Placing the Bud.*—The following will apply either to green shoots or rootlings in the nursery :—

*1st.*—Make a short longitudinal cut on the bark with the blade of the grafting-knife, extending barely  $\frac{3}{4}$  inch in length, and reaching the sap-wood. *2nd.*—Press with the thumb of the right hand on this cut, and with the left hand bend the shoot towards it. *3rd.*—Hold the bent shoot with the left hand, and with the haft of the grafting-knife slightly lift the

bark on both sides of the cut. A small opening is thus made, in which the shield is introduced, sliding it from bottom to top, so as to fit well under the bark. *4th.*—When the scion is introduced allow the shoot to spring up again into its normal position. If the stocks cannot be bent on account of their size or age, a T slit must be made, as is done for fruit trees; in this case the budding of the vine is performed in a similar way, the only difference lying in the method of excising the scion. The latter must be chosen as above described. *5th.*—Ligature with one or more woollen or cotton threads of good quality, so as to be able to tighten it above or below the bud. Raffia must be discarded for small shoots, as it very often gets loose under the influence of heat. It is preferable for the strands not to touch each other. *6th.*—Placed in this way the buds require from fourteen to eighteen days to knit (Fig. 47). Those which have remained green up to that time may be considered as knitted; the others are dried up, and must be replaced if it is not too late, and if there is enough sap, or more exactly if there is an interval of eighteen days preceding the 15th of August\* at the latest; after this period of eighteen to twenty days, the ligatures must be untied, cutting all the strands on the side opposite the bud. The rest of the ligature gradually falls away.

Such is the manual operation required for this new mode of grafting, an operation taking much longer to describe than to perform, for in a day of ten hours a trained workman can make from 300 to 400 grafts without any help.

But it is not sufficient to graft 400 buds in a day. Vine-growers will want to know what proportion of strikes may be expected with this system. To this we shall answer that, as in any other mode of grafting, success depends on the attention and skill of the operator. The experience we personally have of this kind of work enables us to say that, if the bud is well selected, and the stock in full sap, 70 to 85 per cent. of good strikes may be expected. My workmen and myself regularly obtain this percentage every year.

*Preparation of Stocks for Budding with Dormant Eyes.*—With the budding method we may, as previously said, *first*, make grafted rootlings of mother-vines; *second*, bud rootlings in the nursery; *third*, bud stocks several years old,

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\* About the middle of February in Victoria.



with the object of changing the variety. Let us study these different modes of grafting and the results obtainable with them.

*Arrangement of Mother-vines.*—All the shoots of American graft-bearers may be readily budded—that is to say, that one can place on a vigorous shoot from ten to twenty buds, and obtain the next season from one single mother-vine 100 to 150 vine cuttings 10 inches in length, each bearing a dormant eye perfectly knitted. Experience has shown that, to obtain these results, it is necessary to arrange the stocks in the following manner :—

1st. Erect over the line of stocks, stakes 6 to 10 feet high and 9 to 15 feet apart, according to whether there is more or less wind in the district.

2nd. Fix upon these stakes four rows of galvanized wire, Nos. 14 or 13 at least, the first being 16 inches above the ground, and the three others 20 inches apart; stretch these wires with large Walker's patent wire strainers, No. 2.

3rd. As soon as the buds of the mother plant are about 20 inches in length, preserve eight to twelve of the most vigorous of these in the best positions and disbud all the others.

4th. A week to a fortnight after this disbudding, when the bases of the shoot begin to harden, tie them up to the wires, so that after the operation each mother-plant has the shape of a V, or open fan. All axillary buds must be removed, as well as all the tendrils. This should be done at each tying up, which must be repeated at least three times before the 20th of July.\* One must endeavour not to injure the principal leaves, which, as we know, play a very great part in the nutrition of the plant and the formation of its cambium. It is necessary to tie up the shoots of even number stocks on one side of the wire, and odd numbers on the opposite side. By doing so, the shoots are prevented from getting entangled; this greatly facilitates the budding operation, and more especially the gathering, of the cuttings, the buds of which are very easily injured. The reader may think that such an installation, and the operations which it necessitates, are rather fanciful and costly.

The erection of these trellises cost 9s. 6d. per 100 yards. This amount is not wasted, as the canes become well lignified, and the number of buds knitted is greater as

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\* Middle of January in Victoria.

compared with canes left spreading on the ground. The first year we started budding, we did not have recourse to this device, and found great difficulty in separating the shoots, which were to be grafted, and, when this was done, they generally had no leaves left on them; the result was retardation of the movement of the sap, during which the buds suffered, many drying off. The expense of trellising is greatly diminished when the tying is performed at intervals, as the shoots lengthen, and, although they have to be tied separately, one skilful workman may, in a day of ten hours, tie up the shoots of from 100 to 150 mother-plants.

One hundred mother-plants will, therefore, require three days' work before they are ready for budding; that is to say, cost from 4s. to 5s. 6d. for the three successive trellisings. We obtained last year with fine *Riparia Gloire*, four years old, from 164 to 197 feet of wood suitable for budding on each stock, *plus* vine cuttings, 3 feet in length, resulting from the lengthening of the top of the shoots, after the budding had been performed; while with stocks of the same age, left spreading on the ground, we only obtained 49 to 81 feet of wood for budding. With the trellising method we, therefore, gained 3,000 yards of wood per 100 mother plants.

Other American stocks, such as *Rupestris du Lot*, *Aramon* × *Rupestris*, *Gamay Condorc*, produce a little less than the *Riparia*, but still more canes of  $\frac{1}{4}$  inch in diameter with the trellising method. The budding of these trellised shoots may start as soon as their internodes begin to lignify, which may easily be recognised, with a little practice, by feeling, or by the aspect of the bark, which passes from a light green to a brighter colour, and is divided longitudinally by stripes of a more intense green. With tomentose varieties this moment corresponds to the time when the internodes have become partially glabrous.

*Gathering of the Budded Cuttings.*—We should wait until the leaves have completely fallen from the mother-plant before gathering the budded cuttings. In our districts of the south-west this generally corresponds to the second half of November, and budding may be performed until February.\*

However, we think it advisable to gather earlier those which were grafted last, because they are generally placed on the upper part of the shoot which is always less lignified, or, through having had less time to knit, the joint is weaker,

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\* From the 15th May to the middle of August in Victoria.

and they might become detached under the influence of the first winter frosts. It is better to gather each cutting separately, as the buds would get injured if the whole cane was pruned and taken into a shed to be divided into cuttings.

*Stratification of budded cuttings.*—As the budded cuttings are gathered, the eyes of the stock are removed, excising them with a grafting knife as close as possible. Those where the budding has missed are placed apart, and may be used for bench-grafting. The others are placed in cases and arranged in layers of two and three cuttings, superposed, separated by layers of fresh moss or moist sawdust; these should be about 1 inch in thickness, so that 1,500 to 2,000 cuttings may be stratified in a case 3 feet in length by 24 inches in height. When the cases are filled, a lid may be placed on the top, or the last layer of moss or sawdust is made of double thickness.

The cases are then placed in a closed, fresh, and dry room, so that they may not be affected by frost.

The budded cuttings may remain in this state till plantation (February and April).<sup>\*</sup> When the time for planting arrives, these cases are taken to the place (nursery or open ground) where the planting is to be performed. The cuttings are taken out one by one, and their upper section freshened with a grafting knife (never with a secateur), by cutting  $\frac{3}{4}$  to 1 inch below the extremity, and coating with tar or grafting wax. The object of this coating is to seal the medullary channels in which the air and humidity would penetrate, and determine, what is known in horticulture as *necrosis* or desiccation of the cortical tissues, reaching the scion and sometimes below.

Since we have used this method, the vitality of the wood has always been preserved up the extremity of the cutting, and the greater part of the section was, after one year's vegetation, covered with healing tissue.

*Planting Budded Cuttings.*—The planting of budded cuttings is very similar to that of cuttings grafted on the bench, with only this difference, that as the knitting is already completed, no earthing up is required. Each scion must, after planting, be level with the surface of the soil, and it is advisable to cover it with the sawdust which was used for stratification. The other cultural courses are the same as for

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<sup>\*</sup> About August to October in Victoria.



any other grafted cuttings, with this difference, that the roots of the scion do not require to be removed, as in this case the scion never forms any. The proportion of strikes is almost the maximum. We have this year planted out in the vineyard, or in nurseries, over 20,000 budded cuttings of *Riparia* and *Rupestris du Lot* ; 90 per cent. have already shoots 4 to 8 inches in length ; the growth is very rapid, more so than with any other method. We have not budded any *Berlandieri*, but we intend doing so this year with mother plants, which will be prepared next July.

*Budding of Rootlings from one to three years old.*—Let us consider first a plantation of American rootlings planted out last February which would be grafted with the ordinary cleft graft in the spring of 1897. Instead of waiting till then, they may be budded with dormant eyes at the beginning of August with every chance of success, provided the plants are well rooted and well in sap. If some of them are not well rooted, they may be grafted the following year in the same way. At the pruning season in February, all the stocks should be pruned with two spurs and two eyes. The object in doing so is to draw the sap towards the scion till the latter reaches a development of from 13 to 20 inches. It might be necessary to pinch the young shoots of the stock at 4 inches from their base to send the sap back towards the scion. But as soon as the scion has reached a length of 20 inches, the stock must be severed 1 or 1½ inches above it. A small stake must be placed at each stock to tie up the young shoot of the scion and prevent the latter from being disjoined by the spring winds. We have proceeded in this manner for the last few years, and we can show around Montauban many instances of this mode of grafting, where the grafts are loaded with grapes, and which bear more than any other system. We must add that when budding is performed, the vines grow more regularly, and one has not the bother of replacing misses, always occurring with other systems.

With budding, the few misses are easily replaced the following year, as the stock has not been injured ; in this case the Vouzou method with growing eye may be used.

As is apparent, the main advantages of budding for the reconstitution of vineyards are the following :—

1st. Possibility of grafting the first year, of planting out even in dry, pebbly, compact soils, where the method of grafting by decapitation would always result in failures.

*2nd.* Easy execution without any special preparation of the soil (earthing up), as the budding may be performed 4 inches above the level of the ground.

*3rd.* No emission of roots from the scion, and severance of the stock only after the knitting has taken place.

*4th.* Crop-bearing following the year of grafting.

The only drawback of these grafts is the extreme fragility of the scion shoots during the first month of their growth. This is due to the extraordinary growth of the single bud, which seems so weak when dormant, and often throws three or four shoots from this one point, shoots which often reach yards in length at the end of summer.

*Budding of old Stocks.*—With Salgues' green budding, we may at any time transform a European variety already grafted on an American stock or direct producers, Jacquez, Herbemont, &c., without interrupting the crop. These ordinarily can only be replaced by decapitating the stock, and using a cleft-graft. Every vine-grower knows that this system of grafting weakens and generally kills the stock, if the graft misses.

The shoots occupying the best places on the crown of the plant must be preserved when disbudding. In June or July\* one or two buds of the required variety are placed on each of these shoots, and the following year, at the pruning season, all the canes of the stock are cut at  $\frac{1}{3}$  to  $\frac{3}{4}$  inch above the bud, immediately above the last scion. This bud is left to draw the sap towards the scion, and it must only be cut away after the latter has reached a length of 12 to 20 inches. All shoots growing on the old wood (water shoots and suckers) must be disbudded, an operation which should be renewed as often as possible; directly the scions have started to grow properly these suckers cease to appear on the old wood. All the other operations simply consist in erecting a strong stake to fasten the shoots to. The above method may be used for old gooseberry-shaped bushes. We have tried to apply it to vines trained in other ways, such as Cazenave or Royat cordons, or old Jacquez, Herbemont, or even old mother-plants of *Riparia Rupestris*.

The operation is conducted in the following way:—Choose the shoots which are most strongly attached to the plant, and bud them with dormant eyes of Cabernet-Sauvignon.

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\* About December to January in Victoria.

Malbec, Chasselas, or other varieties, placing the buds 12 inches apart on the shoot; the first at  $27\frac{1}{2}$  inches from the ground, so as to be level with the bottom wire on the cordon generally  $15\frac{1}{2}$  inches above the ground. The first bud will be 12 inches from the bend and the last will correspond with the bend of the next cordon.

At the next winter pruning, all the shoots of the vine are removed; the budded one alone is left, and is trained on the wire straight away. This shoot is pruned at the bud over the last scion; this bud, being left to draw the sap towards the scion, is pinched short when the latter are 10 to 12 inches in length. They are then fastened with raffia to the top wire, and directly they reach to 20 or 23 inches the sap-drawer is cut away. We may add, that the canes of all the stocks tried so far increase in diameter at the same rate as the scions, without producing too large a protuberance at the knitting point.

This graft is so handy and so rational that it may readily be used to replace weak spurs on Cazenave, Royat, or Thomery cordons.

Even amateurs may use it to graft different varieties on the same stock.

#### VOUZOU SYSTEM.

A word remains to be added concerning another kind of budding recently invented by Vouzou, vineyard manager for de Verninac, whose property is in the same canton as that of Salgues.

Vouzou, who understood well the *modus operandi* of green budding, hit on the idea of excising the buds from canes of the previous year's growth, such as those used in bench grafting and preserved in sand. The first trial was made in 1892, and the judges of the agricultural show of the Lot, which took place in June and July, were surprised to see the results. Buds grafted towards the end of May on trellised vines, varying in age, were already bearing shoots 10 to 30 inches in length.

This method was pointed out originally by Tallavignes, but it was only in 1894, at the Agricultural Show of Cahors, that we saw for the first time specimens of Vouzou grafts made in 1893 which were loaded with grapes, together with others, grafted only twenty days before on Jacquez and Riparia one year old; these had shoots  $2\frac{1}{3}$  to 4 inches in length.



We were so taken with the results that we bought two of these grafted cuttings, which we dissected, in order to ascertain what kind of adherence existed between the cambiums of stock and scion.

We were surprised to see that twenty days had been sufficient to form a mass of cellular tissue all round the periphery of the scion, and extending on all the parts of sap-wood left bare by the bark lifting on account of its thickness ; therefore, the knitting was absolutely perfect.

This being ascertained, we tried to discover in what way the section of the bud had been made. On lifting it, it was noticed that the operator had made an absolutely plane section, taking about one-third of the diameter of the shoot. Some of the pith had even been left, and the whole of the scion was from 1 to  $1\frac{1}{2}$  inches in length.

With these data, we budded, on the 28th of June, ten stocks of Herbemont, five years old, placing two buds on their trunk at from 4 to 5 inches above the ground, pinching all the shoots above the grapes. A fortnight later it was noticed that twelve buds had knitted perfectly, and were already showing shoots 4 to 5 inches in length. They reached 3 to  $6\frac{1}{2}$  feet before the fall of the leaves, and enormous pads of healing tissues had developed at the joint. These shoots were pruned very short in February last, and they resemble four years Valdiguiers' gooseberry bushes, and bear an abundant crop. Such results induced us to graft last year many hundreds of buds on stocks of all kinds and all ages.

The results were always splendid on old stocks, but rather doubtful on one or two-year-old rootlings.

The following are some ideas and improvements we thought advisable to make in this new mode of grafting:—

1st. It was noticed, in a general way, that buds accompanied by a latent axillary bud did not knit well, as in the case of green budding. We attributed this to the fact that a bud accompanied by a latent axillary bud had not received the quantity of sap required to form a good constitution, or that the small wound resulting from the removal of this anticipated bud had caused it to dry through the evaporation taking place on that section.

To avoid this inconvenience, one must, when selecting the bud-bearing canes, choose those with solitary buds of medium diameter.

*2nd.* A very sharp grafting-knife must be used to excise the bud, cutting obliquely and not perpendicular to the axis of the bud; this with the object of making a very plane section and to avoid cutting the pith, except on a very small surface opposite the bud. We have noticed that all the scions which had too much pith attached to them knitted badly, and that their upper extremity did not knit at all.

Another advantage resulting from this is, that the scion being thinner, the bark of the stock which is to be opened in a T-shaped slit, covers the bud more and shelters it better against the action of the air.

On the other hand, the section being reduced in surface fits better, and its libro-cortical periphery rests exactly on the cambium of the stock, which is very active at the time the graft is performed. This explains the very rapid evolution of this bud.

*3rd.* We also noticed that many of the grafts had a tendency to disjoining from the top, after the ligature had been cut away, although they were perfectly knitted.

This accident does not seem to have very great importance, for, in every case, this little tear of the bark cicatrized, but it checks for a time the free passage of the sap.

We have, to a great extent lessened it by making an incision in the shape of a reversed L. The top aglet is better fixed in this narrow angle, and, the knitting taking place on the two parts of the bark, it will not become disjoined so easily.

*4th.* These buds being lignified and grafted on old stocks require to have a much better ligature than is the case with green buds. Therefore, raffia should be used instead of cotton or wool.

*5th.* The Vouzou budding, contrary to the Salgues budding, is done with a growing-eye as is the case in all vine-grafts made in spring, with wood of the previous year. It is, therefore, evident that all the sap of the plant must be drawn towards that bud.

Does this mean that a complete ablation of the stock must be made, directly after the grafting? No, for this would cause the sap to flow back too suddenly, causing the development of underground suckers, and in nine cases out of ten provoke the desiccation of the scion.

With *Rupestris* and *Riparias*, planted out, we pinched the shoots at three different periods: *1st*, we suppressed half

the shoot directly after budding ; *2nd*, pinched it a little lower a fortnight later ; *3rd*, pruned an inch or two above the ground 25 or 30 days later, when the scion was from 20 to 24 inches in length.

When the scion has reached this development it is strong enough to draw all the sap of the roots towards it, and it acquires a vigour equal to that of the best cleft grafts.

It is absolutely necessary to fasten the shoots of each graft to a strong stake after the removal of the top of the shoot. Like that of Salgues', this graft is very easily disjointed when young.

Towards the end of July the little knob left above the graft is removed by cutting it as close as possible to the scion, and very often this wound heals before the fall of the leaves. When the scions develop properly, the mother-plant never throws suckers even if the mother-plant is a *Rupestris du Lot*, which, as we all know, throws out suckers very freely. In 1895, we performed the Vouzou graft on Bouschet-hybrids already grafted on *Riparia*, and they succeeded without exception.

We noticed that the large wound made on the stock by the severance of the top part induced necrosis, which injures the scions, and we think it would be preferable in future to graft on the spurs of the crown or to place a certain number of scions of the same height all round the trunk. With the help of these scions the wound becomes quickly covered with pads of healing tissue. Later on some of the scions may be cut away and the plant formed in the ordinary way.

Up to the present our own experience leads us to think that there is no method of grafting vines cheaper, and offering greater security of strikes, than budding. With this mode of grafting above ground, the vines may be placed under the same conditions of culture and propagation as other ligneous species. We must admit that the Salgues and Vouzou methods have not up to the present given the results one expected from them, but we must remember that the same fact occurred at the beginning of reconstitution. It required long experiments and many failures before the whip-tongue was accepted as one of the best bench-grafts, and it required many lectures and practical lessons before its use became general. We are convinced that the same thing will happen with budding, when practical lessons are given as to the mode of operation, and that success will quickly generalize its use.



## NEW BUDDING ON THE VINE, MASSABIE GRAFT.\*

BY ARNOLD CHEVALLIER.

A vine-grower of the Lot, Massabie, has devised a new graft for vines, or rather an improvement of the bud grafting, which, according to those who have tried it, gives marvellous results, as 100 per cent. of strikes were obtained. Everybody knows the ordinary budding. The Massabie graft is made on old wood with a bud taken from a one-year-old cane, which has been preserved in dry sand, as is done for ordinary grafts. The operator holds the cane by its base, and excises the bud, cutting from bottom to top, reaching the pith as shown in Fig. 51. This operation is rendered easier by the



Fig. 51.—Massabie Graft.  
Method of excising the Bud.

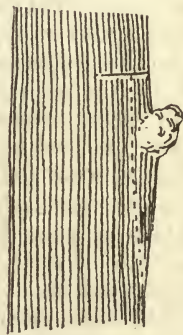


Fig. 52.—Stock ready to be grafted.

use of the secateur shown in Fig. 53. It is advisable to leave the scion-bearing shoot dipped in water for a few hours before excising the bud, as it renders this operation easier. When the bud is excised in this way, the whole bark of the shield is removed, taking care not to touch the bud. This is the secret of this graft, to which its complete success is due. When the scion is ready, it is inserted under the bark of the stock,

\**Revue de Viticulture*, vol. VIII., 1897.

which is opened in a T-shaped slit, the same as is done for any other budding, the top flat part of the scion must rest on the top of the T (Fig. 52). The ligature is made of raffia, starting from the top, as if we started from the bottom, we would risk pushing the scion out of its place.

This graft has the enormous advantage of being made at any time after the month of March,\* when the vine is in full vegetation, and without decapitating the stock ; it gives the

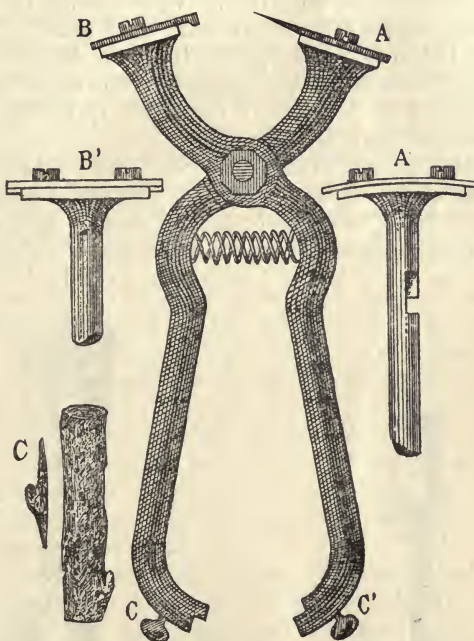


Fig. 53.—Grafting Secateur, used for making the Massabie Graft.

first year extremely vigorous shoots and perfect knitting. As it may be performed on old stumps, it would be very useful for the multiplication of rare *cépages*, which may be grafted on old European vines, and give at once strong wood. It would allow the grafting of old American vines, which knit with much difficulty (*Rupestri*s).

\* September in Victoria.

## CLEFT GRAFT ABOVE GROUND.\*

BY CH. CLARAC,

*Farm Manager at the School of Agriculture, Saint-Sever.*

Amongst grafts above ground the cleft graft is one of the most practical. It is not difficult of execution if one knows already how to perform the ordinary cleft graft. The results are certain if the following precautions are taken.

It is preferable to cut the scion-bearing shoot in autumn, for the bursting of the buds of canes cut in spring may take place before the graft is knitted.

We should operate in the following way:—At the base of the scion an ordinary wedge-shaped section is made, taking care to start level with the bud, and even a little above, to level the protuberance of the node always existing there. The top of the scion is cut  $\frac{1}{2}$  inch above the bud. (Fig. 54.)



Fig. 54.—Scion.



Fig. 55.—Scion and Stock united.

The graft on the stock is performed, as in the case of the English cleft graft, above the node, and the scion is deeply inserted in the cleft, so as to obtain as many points of contact as possible. (Fig. 55.) The graft is bound with strips of

\* *Revue de Viticulture*, vol. IX., 1898.



tin or lead foil  $\frac{3}{4}$  inch to 1 inch wide, and 2 inches to 3 inches long, leaving only the bud of the scion showing. The lead foil, which in the case of underground grafts may be injurious, is indispensable in this case if grafting wax is not used. A strong raffia ligature is then made.

It is very important to insert the scion in the cleft level with its top section, as it is essential to prevent the action of the air on the sections of both stock and scion, for one of the main causes of failures in grafts above ground is that the scion is left exposed to the air.

If we proceed in the above-described manner this graft will knit as well as that performed underground. We also avoid the excess of humidity which may be present in a soil, naturally too wet, or so caused by heavy rains. On the other hand, if the weather is very warm the scion is not liable to desiccate as in the case of underground grafts surrounded with dry soil. The knitting takes place very satisfactorily when tin-foil is used for binding, and the scions grow vigorously.

With this mode of operating we can perform an ordinary cleft, or side cleft graft. The latter should be preferred if we have to deal with planted-out stocks; if the soil is pebbly or too wet, it dispenses with the earthing-up. It is also useful if we desire to change a variety without losing any crop. In this case if we have to deal with vines trained on cordons, a water shoot is left as low as possible, and, in winter, pruned with two eyes. It is grafted, and the cordon continued to be pruned in the usual manner, until the graft can start bearing a crop.

If the vines are trained in the gooseberry-bush fashion, the bud should be preserved in the centre of the stump, pruned with two eyes and grafted; the other spurs are pruned as usual and removed when the graft has become strong enough to bear fruit. The best time to perform this graft is April or May,\* after the vine has ceased bleeding.

*Other methods for cleft grafting above ground.*—A cane is selected on the stock and cut  $\frac{3}{4}$  inch above the bud upon which the graft is to be performed. (Fig. 56.) A cleft is made on one side of it starting  $\frac{1}{2}$  inch above the bud, being careful to split the cane along its axis; the scion cut wedge shape is inserted in the cleft and a strong ligature made as before.

---

\* October or November in Victoria.

Certain varieties of vines knit with difficulty when the graft is performed at the end of a shoot. To increase the strike, a bud is left on the stock above the joint. (Fig. 57.)



Fig. 56. — Other Cleft Graft above ground.



Fig. 57. — Same, with an eye left to draw the sap.

Two buds are thus left to draw the sap towards the scion, they are naturally pinched later on.

*Cleft grafting with hollowed scions.*—It often happens that towards the end of the grafting period, if the scions have been selected to match the stocks, the scions remaining do not correspond with the diameter of the stocks remaining. This difference may exist in a great number of stocks and scions; the work is therefore handicapped and sometimes stopped.

We would propose the following method, which we have used successfully during many years, and which enables vine-growers to use scions of any size.

It consists in slightly modifying the scion used with the ordinary cleft graft. The two slanting sections being made, a little triangular piece *abc* (Fig. 58) is cut away with the point of the grafting knife. The size of this triangular piece is proportionate to the size of the scion. A fork-shaped wedge remains (Fig. 59), the two tongues of which can be brought together, diminishing the diameter and rendering it equal to that of the stock. (Fig. 60.)



Fig. 58. — Scion, before hollowing.



Fig. 59. — Scion, after hollowing.

The scion prepared in this manner is inserted in the cleft, which is pressed against the two little tongues by a strong ligature. Great care must be taken to make the inner bark of both scion and stock coincide throughout their length.

It is important to ligature with a material resisting decomposition so as to hold the two little branches of the fork together until complete knitting. Sulphated raffia washed after sulphating seems to give very good results.

The portion dispensed with in the hollowing, comprises only the pith and a ligneous part which does not influence the knitting. The strike is even increased, as the bringing together of the two branches of the fork allows the generative layers of both stock and scion to coincide over a greater length.



Fig. 60.  
The two tongues  
brought together,  
showing the smaller  
diameter.



## PARDES GRAFT.\*

BY ARNOLD CHAVALLIER.

Pardes discovered two years ago a new and very interesting graft above ground. It is rather a new application of an old method of grafting. It is, in effect, the ordinary cleft graft used for fruit trees which he applied to vines. One operates as follows (Figs. 61 and 62):—

The old stump is cut at the required height, and the section cleaned with the grafting knife. A cleft is made, keeping it open with a little wooden wedge, and the scion with one bud deeply inserted as in the case of fruit trees. Care must be taken not to reach the pith on both sides when making the wedge, to preserve that part of the scion as strong as possible. When the scion is properly placed, the whole section is covered with grafting wax and strongly ligatured with raffia.

This graft is made in March. It has, therefore, a great advantage in case of failures (which are rare if it is properly

performed) of allowing one to graft again, using the Massabie method.

Pardes' method gives in the first year extremely vigorous shoots and even fruit. It forms a perfect and remarkably strong knitting. If the stock is large enough, two scions



Fig. 61.—Pardes Graft.



Fig. 62.

\* *Revue de Viticulture*, vol. ix., 1898.

may be inserted opposite each other as shown in Fig. 63. Pardes exhibited this year at the general Agricultural Show, a graft which had given that same year five shoots, one of which was 13 feet in length.

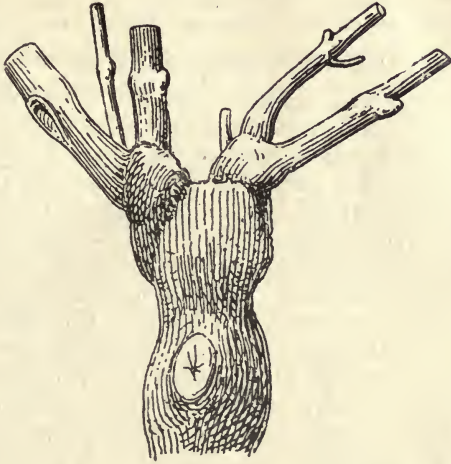


Fig. 63.—Cleft Graft above ground, first year.

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## BUDDING WITH OR WITHOUT SAP-WOOD.\*

BY CH. CLARAC,

*Farm Manager at the School of Agriculture, Saint-Sever.*

## HERBACEOUS BUDDING WITH SAP-WOOD.

The budding with lignified wood is a very ancient graft, although some modern viticulturists think they have invented it. This graft has been applied for a very long time, on the most diverse stocks, and it has never received any modification except that which consists in scraping the inner bark of the scion. We do not know if this modification may be looked upon or regarded as an improvement, for it means a complication in the work, which is not compensated by the increase of the percentage of strikes. We never had more than 50 per cent. strikes at the best seasons, and even then the knittings were not always perfect. These unsatisfactory results might be due to a defect in the execution ; however we think that, under the actual conditions of grafting, this improvement must be disregarded. We attribute these failures to another cause. From personal researches, it results that the non-success of this graft must be accounted for by the method used in excising the bud, causing it to split in many places.

This accident cannot be avoided, and always takes place at the beginning of the cut. This split wood does not knit, and, on account of its desiccation, prevents the knitting from being complete when it does not kill the graft altogether. To insure success in budding with lignified wood we must excise the scion, without splitting it. This is the only modification we make in the old well-known method of budding.

We operate in the following manner :—*1st.* Make a slanting cut, starting at the opposite side of the bud to be excised  $\frac{3}{4}$  inch above it and ending  $\frac{1}{4}$  inch below. This cut is concave (cut *a c b*, Fig. 64), the operator will get rid of a useless portion of the cane (*a b d*). This part bears the wood, bruised by the grafting-knife. *2nd.* The cane is reversed end to end, its natural extremity pointing towards the body of

\* *Revue de Viticulture*, vol. X., 1898.



the operator and the section *ce* (Fig. 64) made, the first finger pressing under the bud in *g* to hold the scion. It is easily seen in this second cut that it is the point in *c* which will bear the split wood. Finally, if the grafting-knife had a tendency to come out too far from the bud, a third section *fe* would be made, leaving the scion neatly cut without any bruised edges.

One must be careful to make the second cut *ce*, very flat, which is easy, as the first cut has been made concave.

It is easier to start excising the bud from the base of the cane.

We must notice that the scion-bud, excised with a plane section, has to fit on a convex surface; it will fit better if we take these buds from small canes, and particularly from axillary shoots. In this way the plane section will be narrower, and will fit better on the cylindrical surface.

As this graft is generally made on old stocks it will always be easier to find on the latter, the least convex surface, upon which the bud is placed under more favorable conditions.

If required, we may partially scoop out the scion, to render its internal surface concave, and therefore the contact of the stock more complete, and the knitting easier.

It is preferable to take the eyes from canes of very small diameter, although this is a slight complication.

The bud being inserted on the stock a strong ligature is made with raffia.

It is important to gather the scion-bearing canes before the cold season, to select them well lignified and preserve them in dry sand up to the time of grafting, that is to say, May, or the beginning of June.\*

Another very important fact which must not be neglected is, to take only the buds which do not bear any



Fig. 64.—Showing the directions of the cuts in the new method of excising the Bud.



Fig. 65.—Scion with Flat Section.

\* November or December in Victoria.

wounds or axillary buds. We must avoid wounded scion-buds, for it is always from these wounds that desiccation starts.

We have often seen grafts not starting to grow until the following spring; therefore, we must not conclude that the graft is lost, simply because it does not start growing the

year it has been performed. All these details must not be neglected; they all are necessary conditions of success, and all operators know how delicate the grafting above ground is, and how many failures have been met with. We have studied this graft successfully for many years, and are convinced as to its results when made under the conditions above described.

After a few trials, the operator acquires the way of using the grafting knife so as to graft well and quickly.



Fig. 66. — Graft made with Flat Scion.



Fig. 67. Curved Scion for grafting on old stock.

These modifications also apply to the grafts known as *inlaid-budding*. The bud in this case is excised, starting from the opposite side, as previously. If the scion is to take the place of another bud it is easy to see that the section must be plane, and that it will easily fit on the stock (Figs. 65 and 66).

If the scion is to be placed on an internode or old stock, its section must be slightly curved (Fig. 68). We see that the section of the bud (Fig. 67) has to be curved in the same way. This graft must be waxed, or ligatured with lead foil.

The best time to make these grafts is the end of May or the beginning of June,\* when the vines have ceased to bleed.

#### HERBACEOUS BUDDING WITHOUT SAP-WOOD.

The Salgues budding with sap-wood is a very difficult mode of multiplication, even notwithstanding all the improvements made upon it by different horticulturists, and the causes of its non-success are not well known. The main

\* November or December in Victoria.

causes are always the same. Salgues' scion is excised with a flat section forming a large wound; this flat section does not fit well on the cylindrical internode of the stock, and it adheres less opposite the bud, where it touches the stock only by its centre; the layer of sap-wood still left under the bud is interposed between the stock and the scion and partially prevents complete knitting, if the lignification of the sap-wood has started. It is therefore important to excise the bud with as little sap-wood as possible; this *modus operandi* is applied with rose-trees or any other species, but the great difficulty with vines is that the green bark is so extremely delicate, that, if the operator touches the inside of it with the point of the grafting-knife, when removing the ligneous part, the graft is lost.

We first tried the *half-sap-wood budding* which gives fairly good results, but it must be ligatured with rubber or wool. This is a great disadvantage, and, until a cheaper ligature is found, allowing this graft to enter a more practical domain, the half-sap-wood budding can only be considered as an amateur graft. It is very convenient when one only has a few stocks to graft as its strike is practically assured.

As we considered the sap-wood in Salgues' shield as being the main cause of its non-success, we endeavoured to bud without any sap-wood at all. The idea is not new, but we did not pursue it on account of the difficulty found in removing the sap-wood of the shield without injuring the bark, and without completely scooping out the bud.

Professor Horvath, of Hungary, performs this graft as follows:—He selects the time when the vines are well in sap, excises the bud without wood, makes a double T or single T slit on the stock, the longitudinal cut always passing through the centre of the bud of the stock without touching the *alburnum* under it; he places the bud,



Fig. 68.—Graft on old Stock.



fitting the concave part under the scion, over the protuberance of the node on the stock which has remained intact, but as the bud and the stock could never fit perfectly together a hollow space always remained between them, which, in the majority of cases, brings about desiccation. This desiccation even occurs after the knitting has taken place.

It is for this reason that we tried to bud without sap-wood, replacing the node of the scion in its natural cavity.

*Method of excising the bud.*—The cane is held with the base towards the body, the bud lifted by making an incision, starting under the eye at  $\frac{1}{2}$  inch from it,  $\frac{1}{16}$  inch in thickness; this incision is continued down to  $\frac{3}{4}$  inch below the eye (Fig. 69). A transversal section perpendicular to the first one is made, as shown by Fig. 70, reaching the sap-wood. Seizing the bark of the scion between the thumb and the first finger, it is lifted, and the part of the sap-wood shown in Fig. 73 remains attached to the cane. The shield shown in Fig. 72 is thus obtained. The two angles at the bottom are cut to facilitate its introduction under the bark of the scion. (Fig. 71.)



Fig. 69.



Fig. 70.

Method of excising the Bud.

Fig. 73 shows a cane from which a scion has been removed. The protuberance of the node has not been touched. It is cut at *d c*, and is replaced under the scion in the place it first occupied. This little operation is done without touching the node with the fingers. It is placed in the natural cavity on the scion by simply turning the cane over. (Fig. 74.)

The slit on the stock must be T-shaped. That used by Salgues, which answers very well with sap-wood shields, is impracticable for shields without sap-wood. The bud is not rigid enough, and cannot be introduced into the Salgues slit without being injured. One must take care not to displace the little protuberance. The ligature is also of very great importance

Fig. 73 shows a cane from which a scion has been removed. The protuberance of the node has not been



Fig. 71.



Fig. 72.

Shields.

It must start from the top of the graft, leaving a space of  $\frac{1}{20}$  to  $\frac{1}{10}$  of an inch between the strands, pressing at the same time upon the bud with the thumb, so as to make it coincide exactly with the stock. One of the strands must pass



Fig. 73.—Cane from which a Scion has been removed, showing the way of cutting the protuberance—*c d*.

between the petiole and the bud, or over the section of the petiole if the latter has been previously cut away. In either case the turns should pass as close as possible to the bud, so as to secure its adherence in that position. (Fig. 75.)

The shoot bearing the scion buds must be taken from a healthy mother plant in full vegetation. It should be at least  $\frac{1}{4}$  inch in diameter.

The petiole of the leaf accompanying the bud to be grafted is generally cut at  $\frac{1}{4}$  inch above its point of insertion. When fruit trees are budded this leaf is always cut away, and in this case it only presents advantages. The petioles of fruit tree leaves are not as spongy as those of vine leaves, and their section heals quickly; but in the case of vines the section of the base of the petiole presents a much larger area, and as it contains a great quantity of water, evaporation from the herbaceous part is abundant, and, in the majority of cases, will destroy the scion.



Fig. 74.  
Scion showing  
protuberance  
placed in its  
natural cavity.



Fig. 75.  
Ligature.

To diminish these accidents, we tried leaving a few tenths of an inch of the limb attached to the petiole. The desiccation in this case did not take place so rapidly, but another accident occurred; after a few days the fall of the petiole formed a wound at its base, which in the majority of cases compromised the success of the graft. It would be advisable to remove the leaf a fortnight before budding. In this case

the wound would have time to heal on the shoot bearing the buds, and the danger of desiccation would be greatly diminished. To remove the leaf without tearing the buds of the petiole, a sharp downward pull is given; with varieties in which the petiole does not get detached easily it should be cut  $\frac{1}{2}$  to 1 inch above its point of insertion, and a few days later the small piece remaining can be easily removed. The section obtained is neater, but it will require another week to completely heal.

We do not recommend the use of scions bearing axillary buds. These would have to be removed before they attained  $\frac{1}{2}$  inch in length, and their development would produce a swelling of the node, complicating the operation of grafting. The bud being more swollen its adherence to the stock would be difficult to obtain.

Finally, the scion-bearing shoots, being prepared as above described, we take all the buds from the middle part, leaving the buds of the base, generally too much lignified, and which, for this reason, would get completely hollowed, and the buds of the extremity, which cannot be hollowed properly. If the node at the base of the bud is shining, it shows that the bud is not sufficiently ripe. The scion-bearing shoot has reached proper lignification when the number of buds which can be detached (leaving a part of the bark adherent to them, and under the eye about  $\frac{1}{16}$  inch of alburnum proceeding from the protuberance, which, when excised in this way, presents an irregular surface) is greater.

#### HERBACEOUS BUDDING WITHOUT ALBURNUM, AND WITHOUT COMPLETELY HOLLOWING THE SHIELD.

Budding without alburnum and without complete hollowing of the shield is not new. It has been used for fruit trees, and we tried to apply it to vines with all the chances of success it presents with other species. The difficulty only resides in the method of excising the scion.

Practical operators will appreciate the advantages of allowing the wound at the base of the petiole to heal before performing the operation. If we add to this modification the following, we think that the maximum chance of success will be obtained. This modification is only a simplification in the execution of the graft without alburnum and replacing of the protuberance. It consists in excising the bud without alburnum and without completely hollowing the eye.



*Method of Excising the Bud.*

When the scion-bearing shoot has all its wounds completely cicatrized, it is cut from the mother plant and the herbaceous extremity removed.

The cane is then seized with the left hand, its extremity pointing towards the body of the grafter. The buds at the base are excised first. The length of the shield must be from 1 to  $1\frac{1}{2}$  inches. The section is started with the base of the grafting knife, allowing it to gradually slide, until it reaches the other extremity of the section. When the blade reaches the level of the cicatrice it should be lifted a little, so as to continue the section parallel to the axis of the cane and of  $\frac{1}{25}$  to  $\frac{1}{16}$  in. The transversal section *ab* (Fig. 76) is made, cutting through the bark only. The bud is seized between the thumb and the first finger, level with the section *ab*, and slightly pulled away from the alburnum. The scion is then seized with the thumb resting on the section of the petiole, and the first finger on the bud, and to avoid it becoming completely hollowed a kind of rocking motion is given, gradually drawing the thumb back as the alburnum gets detached. By doing so, a part of the alburnum is left adherent to the stock in the shape of a fork (Fig. 77), and the scion thus obtained is a half-alburnum bud. If, in this operation, the alburnum breaks without forming the fork, the bud should be rejected, as it means that it is not ripe enough.



Fig. 76.—Method of excising the Bud.



Fig. 77.—Alburnum left adherent to the Stock.

the point of the grafting knife as indicated by Fig. 78.

The delicate part of the operation consists now in removing the rest of the alburnum without hollowing the eye. We can only attain this result by operating in the following manner :—

A small triangle of alburnum *abc* (Fig. 80) is removed, using

The point following the line *cb* up to the point where the alburnum touching the bark gets harder. The point of the knife is then lifted, cutting away the part of the alburnum opposite the bud.

To facilitate the operation the thumb rests on the extremity of the blade, preventing it from penetrating deeper than necessary. This little operation forms a notch, weakening the small tongue of alburnum left under the bud, and it is at that point that the separation of the alburnum from the bark takes place. This is done by seizing the extremity of the tongue between the thumb and the point of the grafting knife and pulling it away from the bark, forcing it to

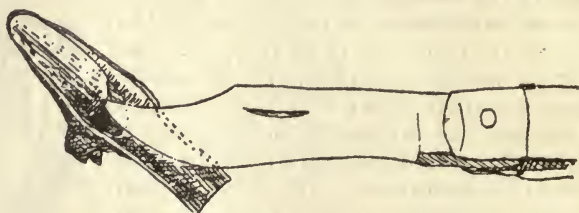


Fig. 78.

describe half a circle (Figs. 80, 81, and 82), retaining the thumb on the wood left under the shield. We obtain in this manner a scion which is not hollowed, and the bark of which has not been bruised. (Fig. 83.)



Fig. 79.



Fig. 80.



Fig. 81.



Fig. 82.



Fig. 83.

One must not wait until the swelling of the node is too great before cutting the leaves away from the scion-bearing

shoot, for the swelling would prevent the complete adherence of the scion to the stock. If, however, we were forced to utilize such swollen buds, we should require to leave a small portion of alburnum under the eye, so as to secure complete adherence.

The scion thus prepared is placed either in an I or T shaped slit. To facilitate its introduction in the I slit, the angles at the top of the scion should be cut away. The ligature is made with wool, the strands passing as close as possible to the eye, forcing, with the thumb, the scion to rest completely on the stock.

Although it is preferable to ligature with wool, it is sometimes necessary to use raffia (Fig. 84). In this case we must not forget to turn five or six strands more at both extremities of the graft. One of the disadvantages of raffia is that when the joint increases in diameter it penetrates into the bark and produces swelling, as it is not as elastic as wool. It may even produce a new wound on the cicatrice of the petiole and bring about the death of the scion. We also know that raffia shrinks and stretches under the influence of humidity, and this is another reason for discarding it.



Fig. 84.

#### ADVANTAGE OF BUDDING WITHOUT ALBURNUM AND WITH PARTLY HOLLOWED SHIELDS.

This graft had been abandoned on account of the difficulty of removing the alburnum without bruising the bark and without completely hollowing the bud, and above all, because when the petiole got detached the wound it produced favoured great evaporation, and was one of the main causes of failure.

The method of budding by replacing the protuberance of the node did away with the first of these inconveniences. The bark was not bruised. By previously removing the leaf,



this graft gives satisfactory results. However, if the buds are not ripe enough when the grafting takes place they will not grow.

The graft in which the eyes are only partly hollowed, prevents the second inconvenience, and has also the advantage of allowing the use of a much greater number of buds. This is the safest green graft, and may be performed during a very long period, from June till the end of August.\* Its shoots are very vigorous.

These grafts may be performed with dormant or growing eyes. It is preferable to use dormant eyes, as lignifying takes place under more favorable conditions. If we wish to obtain growing eyes, the shoot should be pinched a fortnight after the operation.

These buds can also be placed on old wood.

The grafting knife used for the whip-tongue graft cannot be used for budding. The ordinary gardener's budding knife, with Kund's blade, should be preferred.

Practical grafters who have only been accustomed to cleft-grafting will not succeed at first with herbaceous budding, but we must remember that the whip-tongue graft was found quite as difficult of execution when it was first invented, and it was not without great difficulties, experiments, and, above all, conviction of its merits, that it became practical, and is now used by every vine-grower. We wish to impress upon the reader the necessity of learning the budding of vines by practice in the vineyard. However, it will be found to be easier of execution than the whip-tongue, and, as all nursery-men, and most gardeners know already how to bud fruit trees, there is no reason why this method of grafting, with all its advantages, should not become generally used.

---

\* December to February in Victoria.

## CLEFT BUDDING.\*

BY ARNOLD CHAVALLIER.

Plessard-Plane, gardener at Petit-Pressigny (Indre-et-Loire), has invented a new graft, which is performed in the following way:—

1. *Preparation of the Scion.*—To excise the bud of the scion-bearing shoot, the latter is cut at AB (Fig. 85), the top section being previously made  $\frac{1}{4}$  inch above the bud, which is finally detached by an oblique section CD.

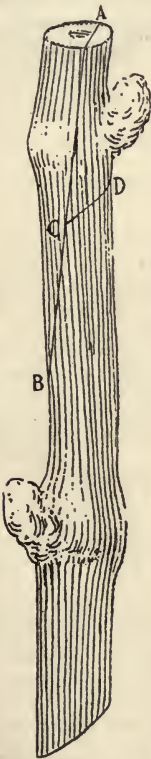


Fig. 85.



Fig. 86.



Fig. 88.

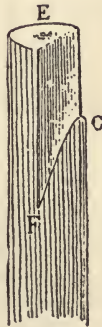


Fig. 87.



Fig. 89.

2. *Preparation of the Stock.*—A vertical cut EF (Figs. 87 and 88), and an oblique one GF, are made, forming the lodgment for the scion (Fig. 86), which is inserted, the top sections of both scion and stock being covered with grafting wax (Fig. 89) made in the following way :—

Beeswax	...	...	100	parts by weight.
Bottle wax	...	...	100	„ „
Stockholm tar	...	...	100	„ „

This compound is used warm ;  $2\frac{1}{4}$  lbs. is sufficient to wax from 1,200 to 1,500 grafts.

This graft is performed on the bench in spring. It gives a percentage of strikes equal to that of the whip-tongue graft and far superior knitting. It might be used as graft above ground on canes of the preceding year, being careful to completely wax and tar the joint and ligature it with raffia.



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